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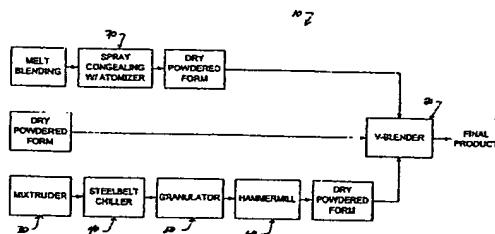
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(54) Title: GUM BASE AND GUM MANUFACTURING USING PARTICULATED GUM BASE INGREDIENTS



(57) Abstract: A particulated gum base comprises particulated elastomer ingredients and particulated spray congealed ingredients having a size of less than or equal to about 1 millimeters. A method of making a particulate blend gum base comprises the steps of providing at least one first gum base ingredient having a softening point of less than about 130 °F, providing a second gum base ingredient, combining at least the first and second gum base ingredients to form a combined ingredient having a particulate form, blending at room temperature the combined ingredient with a third gum base ingredient to form the powder blend gum base, the powder blend gum base comprising at least an elastomer, a softener, an antitack ingredient and a filler. An improved method for making chewing gum products and gum base products. A method of preventing agglomeration of particulate gum base products. A remotely controlled method of making a particulate blend gum plate. A method of making chewing gum products and gum base products having improved consistency from one batch to the next. An improved method for making gum base products having reduced changeover costs from the manufacture of one product to the next. An improved method of making gum base products using the same equipment having reduced contamination from one formulation to the next. An improved method of making gum base products having temperature sensitive ingredients. An improved method of making chewing gum products using reduced temperatures. An improved method of making a batch of chewing gum. A method of making a gum and wrapping gum products without conditioning. A free-flowing, particulated gum base comprises particulated rubber ingredients having a size of less than or equal to about millimeters. The gum base is prepared by blending together particulated gum base ingredients including an elastomer, elastomer plasticizer and preferably a filler. The elastomer and elastomer plasticizer may be pre-blended and then pulverized before being blended with the other gum base ingredients to form the free-flowing, particulated gum base.

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## GUM BASE AND GUM MANUFACTURING USING PARTICULATED GUM BASE INGREDIENTS

### BACKGROUND OF THE INVENTION

The present invention relates to a novel process for making a  
5 particulate blend gum base and the final gum product.

Conventionally, it has been impractical to use the same optimum  
conditions for manufacturing gum base and for manufacturing gum products  
from gum base and other ingredients such as sweeteners and flavors. For  
instance, conventional gum base manufacture typically involves the dispersive  
10 (often with shear) mixing of difficult-to-blend ingredients such as elastomer,  
filler, elastomer plasticizers, base softeners/emulsifiers and, sometimes wax  
and typically requires long mixing times. Conventional gum product  
manufacture involves combining the gum base with more delicate ingredients  
such as product softeners, bulk sweeteners, high intensity sweeteners and  
15 flavoring agents using distributive mixing, for shorter periods.

Gum base is typically manufactured and then shipped to chewing gum  
manufacturers who blend it with various ingredients to formulate the  
commercial gum product.

Typically, the manufacture of conventional chewing gum base involves  
20 adding gum base ingredients, either separately or simultaneously, into a  
heated sigma-blade, twin-screw or continuous mixer. The gum base  
ingredients often must be size reduced either by shredding or crushing, to  
obtain the desired quantity for a batch of gum base and to feed the  
ingredients into the mixer. Conventional chewing gum base includes one or  
25 more elastomers, one or more fillers, plasticizers and, optionally, polymers,  
waxes, emulsifiers and miscellaneous colors, flavors, sweeteners, and anti-  
oxidants. Gum base manufacture is typically a tedious and time-consuming  
process primarily due to the difficulty in melting and dispersing the elastomers  
homogeneously among the other gum base ingredients. In preparing gum  
30 base, it is important that the elastomeric portion be thoroughly mixed with the

other components, which are included in the base composition to effect various characteristics of the resulting gum composition, so that the entire gum base product will retain proper resiliency as a homogeneous phase. In the mixer, the gum base ingredients are melted and mixed together to form a homogeneous molten mixture. The melted mix at times is blended, or compounded. The compounding of conventional gum base typically requires 20 minutes or longer in the presence of high heat, typically between about 150° F and about 250° F, and shear. As the mixture is compounded, the plasticizers and, optionally, softeners reduce the molecular weight of the elastomers. This results in a final gum base product that has a more uniform consistency and is free of lumps and other irregularities. In conventional gum base manufacture, the more uniform the gum base product is before it is added to the gum making process, the more uniform and homogeneous the final gum product will be. After compounding, the hot viscous melt is passed through a filter to remove any foreign materials or impurities.

Cooling and solidifying the hot viscous gum base for shipment and storage presents further processing problems and also requires expensive machinery and time-consuming handling techniques. The hot viscous melt can be pan-molded or extruded into blocks, or as pellets packed in plastic lined cartons or sealed in containers. The molds, however, may require an anti-sticking coating and considerable hand labor to clean the molds for reuse. In addition, to formulate the blocks or slabs of gum base into gum compositions, the blocks must be broken into small particles by milling or crushing before they may be admitted to a blender for processing into gum compositions.

In the alternative, the hot viscous melt may be pelletized. From the filter, the hot viscous material falls into a receptacle and when required, is cooled to obtain a viscosity suitable to put it in solid form. When the molten gum base has been cooled to a form retaining temperature of around 140° F, it is conveyed to a pelletizer. The pelletizer forms varying sizes of pellets from the gum melt by extruding the gum melt through the die. The pellets may proceed to a tumbler where a dusting agent, for example, calcium carbonate

or talc powder is applied to the pellets to prevent adhesion, agglomeration, and the like, before the pelleted gum base is eventually used in the production of chewing gum. However, in spite of the individual powder coating and sealed containers, the pellets may still tend to agglomerate.

5           Several factors such as vibration during shipment, the pressure within the container due to the depth of product and temperature promote agglomeration. For this reason, it is common to limit the size or height of the containers and/or refrigerate the pellets at a temperature not to exceed 41° F.

10           The powder coating used to minimize agglomeration can present further manufacturing problems. For instance, seasonal changes must be taken into account in varying the proportions of powder utilized as a coating. Also, the powder must uniformly coat the gum base pellets. A non-uniform coating, settlement of the powder during shipment or the sudden release of powder left behind at any point of handling may lead to variations in the  
15           powder concentration and cause difficulty in formulating the end product.

          When used to make gum compositions, the pelleted gum base is melted and mixed with the other gum ingredients. The molten gum composition is extruded into slab form, fed through a series of rollers to reduce the slab to the thickness of a gum stick and scored. The scored gum  
20           is then placed into a conditioning room at a temperature of about 55° F to about 70° F, at 50% relative humidity for about 8 to about 24 hours. Thereafter, the gum sticks are wrapped.

          It is believed that the exposure of the gum base, and subsequent gum composition, to the processing conditions imparted by the manufacture of  
25           conventional gum base, and conventional gum composition, contributes to the need to temper, or condition, conventional gum compositions before the final gum product is wrapped.

          There remains a need or desire in the chewing gum industry for an improved method for making chewing gum products and gum base products.

30           There remains a need or desire in the chewing gum industry for methods of preventing agglomeration of particulate blend gum base products.

There remains a need or desire in the chewing gum industry to minimize the manufacturing costs resulting from the changeover from one gum base to another.

There remains a need or desire in the chewing gum industry to provide a remotely controlled method of making a particulate blend gum base.

There remains a need or desire in the chewing gum industry to provide a method of making chewing gum products and gum base products having improved consistency from one batch to the next.

There remains a need or desire in the chewing gum industry to provide an improved method of making gum base products using the same equipment having reduced contamination from one formulation to the next.

There remains a need or desire in the chewing gum industry to provide an improved method of making gum base products having temperature sensitive ingredients.

There remains a need or desire in the chewing gum industry to provide an improved method of making chewing gum products having temperature sensitive ingredients.

There remains a need or desire in the chewing gum industry to provide a method of making chewing gum products using reduced temperatures.

There remains a need or desire in the chewing gum industry to provide an improved method of making a batch of gum.

There remains a need or desire in the chewing gum industry to provide an improved method of making a gum and wrapping gum products without conditioning.

## BRIEF SUMMARY OF THE INVENTION

In a first aspect, the invention is a method of making a particulate blend gum base comprising the steps of: providing at least one first gum base ingredient having a softening point of less than about 130° F; providing a second gum base ingredient; combining said at least one first and second gum base ingredients to form a combined ingredient having a particulated, free-flowing form; blending the combined ingredient at a temperature in the

range of about 40°F to about 90°F with at least a third gum base ingredient to form the particulate blend gum base, said particulate blend base comprising at least an elastomer, a softener, an antitack ingredient, and a filler.

In a second aspect, the invention is a method of making a particulate  
5 blend gum base that uses soft elastomers comprising the steps of: melting a soft elastomer and an elastomer plasticizer together to form a homogeneous molten mixture; cooling and processing the homogeneous molten mixture to form a solid mixture in a particulated state; and blending the particulated soft elastomer/elastomer plasticizer with other gum base ingredients to form said  
10 gum base.

In a third aspect, the invention is a method of making a particulate  
blend gum base that uses at least one soft elastomer comprising the steps of:  
melting at least one soft elastomer and at least one polyvinyl acetate together  
to form a homogeneous molten mixture; cooling and processing the  
15 homogeneous molten mixture to form a solid mixture in a particulated state;  
and blending the particulated soft elastomer/polyvinyl acetate with other gum  
base ingredients to form said particulate blend gum base.

In a fourth aspect, the invention is a method of making a particulate  
blend gum base comprising: providing a fat and a wax; mixing the fat and the  
20 wax together in a molten state; cooling the fat and wax blend and forming a  
particulate material; and blending the fat and wax particulate material with  
other particulated gum base ingredients to form the particulate blend gum  
base.

In a fifth aspect, the invention is a method of combining a fat and wax  
25 to form an ingredient that can be used to make a particulate blend gum base  
comprising the steps of: providing a fat selected from the group consisting of  
fully saturated oils that contain, as one or more of their constituent groups,  
fatty acids of carbon chain length of from 6 to 18 and triglycerides having a  
total summated saturated caprioic, caprylic, capric, lauric, myristic and  
30 palmitic fatty acid content of from about 8 to about 60 percent by weight of the  
fatty acids, determined from the fatty acid methyl ester distribution by gas  
chromatography; providing a wax selected from the group consisting of

petroleum waxes containing predominantly iso-alkanes having a carbon chain lengths greater than about 30, and synthetic waxes; melting the fat and wax together to form a melted fat and wax blend; cooling the melted fat and wax blend to form a particulated gum base ingredient.

5           In a sixth aspect, the invention is a method of preparing a particulate blend gum base comprising the steps of: melting a gum base ingredient; spraying the melted gum base ingredient through an atomizing nozzle and cooling the ingredient to form a solid, particulated gum base ingredient; and  
10           blending the particulated gum base ingredient with other particulated gum base ingredients to form the particulate blend gum base.

          In a seventh aspect, the invention is a method of making a particulate blend gum base comprising the steps of: blending two or more gum base ingredients together in a liquid form to form a combined ingredient; said  
15           combined ingredient having a viscosity of less than 80,000 centipoises at about 250° F; solidifying the combined ingredient in a particulated form; and blending the particulated combined ingredient with at least one other gum base ingredient to form the particulated blend gum base.

          In an eighth aspect, the invention is a method of making a particulate blend gum base comprising the steps of: providing a first gum base ingredient  
20           having a softening point greater than 130°F; providing a second gum base ingredient; melting and blending said at least first gum base ingredient with said second gum base ingredient to form a combined ingredient having a liquid form; spraying said combined ingredient to form an atomized spray; hardening said atomized spray to form a combined ingredient that is then  
25           used to make said particulated blend gum base.

          In a ninth aspect, the invention is a method of making a particulate gum base comprising the steps of: providing a first gum base ingredient that has viscosity greater than about 80,000 centipoises at 250°F; providing a second  
30           gum base ingredient; blending and melting said at least said first and second gum base ingredients to form a combined ingredient having a viscosity less than about 80,000 centipoises at 250°F; spraying said combined ingredient to

form an atomized spray; hardening said atomized spray to form an ingredient that is then used to make said particulate blend gum base.

In a tenth aspect, the invention is a method of preventing agglomeration of one or more particulate gum base ingredients comprising the steps of: providing a plurality of particulate gum base ingredients; blending the plurality of particulate gum base ingredients; and adding an anti-caking agent to the blend of particulate gum base ingredients at a level sufficient to prevent the blend of particulate gum base from agglomerating when left unagitated at a temperature of at least 58° F for a period of at least about 48 hours.

In a eleventh aspect, the invention is a method of preventing agglomeration of one or more particulate gum base ingredients comprising the steps of: providing a plurality of particulate gum base ingredients; blending the plurality of particulate gum base ingredients; and agitating the blend of particulate gum base ingredients until just prior to the addition of the blend of particulate gum base ingredients to a gum mixer.

In a twelfth aspect, the invention is a method of manufacturing gum base so as to have a high degree of consistency from one batch to the next comprising the steps of: a) providing gum base ingredients in a particulate form; b) particulate blending the gum base ingredients together without forming a molten gum base to form a first batch of particulate blend gum base; said first batch of particulate blend gum base having a first ash content, a first antioxidant content and a first softening point; repeating steps a) and b) to form a second batch of particulate blend gum base; said second batch of particulate blend gum base having a second ash content, a second antioxidant content and a second softening point; wherein said first ash content and said second ash content have a variation of about 5% or less.

In a thirteenth aspect, the invention is a method of manufacturing a first gum base having a first composition and subsequently manufacturing a second gum base having a second composition, using the same equipment and minimizing the amount of the first composition carried over into the second composition between the manufacture of the first gum base and the



second gum base comprising the steps of: providing a plurality of first gum base ingredients in particulate form; providing a plurality of second gum base ingredients in particulate form; adding the plurality of first gum base ingredients to a mixer, particulate blending the plurality of first gum base ingredients to form a particulate blend of first gum base ingredients and emptying the particulate blend of first gum base ingredients out of the mixer; said mixer retaining a residual amount of first gum base ingredients of less than about 1% of the volume of the mixer; and adding the plurality of second gum base ingredients to the mixer and powder blending the ingredients to form the second gum base.

In a fourteenth aspect, the invention is a method of making a particulate gum base from a plurality of gum base ingredients in a particulate form comprising the steps of: providing a plurality of storage compartments each storing at least one of said plurality of gum base ingredients in a particulate form; providing automated controls to allow remote control dispensing of said at least one of said plurality of gum base ingredients in a particulate form from each of said storage compartments; selecting a gum base to be made; remotely activating said controls to dispense a desired amount of each of said at least one of said plurality of gum base ingredients in a particulate form from said plurality of storage compartments; and blending the desired amounts of the plurality of gum base ingredients in particulate form to form a particulate blend gum base.

In a fifteenth aspect, the invention is a method of making a batch of gum comprising the steps of: providing one or more containers that contains pre-weighed amounts of a plurality of gum base ingredients sufficient to form one batch of gum, the plurality of gum base ingredients being in a particulate form; emptying the entire contents of said one or more containers into a gum mixer; adding additional gum ingredients to the gum mixer sufficient to form one batch of gum; and mixing the gum base ingredients and additional gum ingredients to form a batch of gum.

In a sixteenth aspect, the invention is a method of manufacturing gum comprising the steps of: providing a plurality of particulated gum base

ingredients; providing additional gum ingredients; adding a combination of the particulated gum base ingredients to a gum mixer as a particulate blend; the gum mixer having an initial kettle temperate of between about 20° C (or 68° F) and about 40° C (or 104° F); adding the additional gum ingredients to the mixer; mixing the combination of the particulated gum base ingredients and additional gum ingredients in the gum mixer to form a gum composition.

In a seventeenth aspect, the invention is a method of making a gum composition using reduced temperature comprising the steps of: providing gum base ingredients in a particulate form; adding the particulate gum base ingredients to a gum mixer; adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition, the contents of the mixer not exceeding a temperature of 120° F throughout the mixing process.

In an eighteenth aspect, the invention is a method of making chewing gum comprising the steps of: providing at least one first gum base ingredient having a softening point of less than about 130° F; providing a second ingredient that is used to make chewing gum; combining at least said first gum base ingredient and said second gum ingredient to form a combined ingredient having a particulated form; and combining the combined ingredient with at least a third gum ingredient to form a chewing gum composition.

In a nineteenth aspect, the invention is a method of making a chewing gum composition that contains a temperature sensitive ingredient comprising: providing a particulate blend gum base; adding the particulate blend gum base to a gum mixer; adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients to form a chewing gum composition, the temperature sensitive ingredient being mixed into the other ingredients earlier in the mixing process than when the temperature sensitive ingredient is conventionally mixed into the chewing gum composition made using a melted gum base.

In a twentieth aspect, the invention is a method of making a gum composition that contains a temperature sensitive ingredient comprising: providing a particulate blend gum base; adding the particulate blend gum

base to a gum mixer; adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients, including said temperature sensitive ingredient, for a period of time to form a gum composition; said period of time being shorter than the period of time required to mix a conventional gum composition using a melted gum base.

In a twenty-first aspect, the invention is a method of making a gum composition that contains a temperature sensitive ingredient comprising: providing a particulate blend gum base; adding the particulate blend gum base to a gum mixer; adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients including said temperature sensitive ingredient, to form a gum composition; the temperature sensitive ingredient being mixed into the other ingredients with the initial addition of gum ingredients in the mixing process.

In a twenty-second aspect, the invention is a method of making a gum composition using reduced temperature comprising the steps of: providing gum base ingredients in a particulate blend form; adding the particulate blend gum base ingredients to a gum mixer having an initial kettle temperature of between about 20° C (or 68° F and about 40° C (or 104° F); adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition.

In a twenty-third aspect, the invention is a method of making a gum composition and wrapping gum products made therefrom without the need to condition the gum composition prior to wrapping, comprising the steps of: using a particulate blend gum base to make a gum composition; forming the gum composition into gum sticks; and wrapping the products without conditioning the gum sticks.

In a twenty-fourth aspect, the invention is an improved method of making a gum composition wherein the improvement comprises using a gum base in a particulate blend form and mixing the gum for less time than would be used to make the same gum composition using a gum base having the same composition as the particulate blend but in a melted state.

In a twenty-fifth aspect, the invention is a method of making a particulated chewing gum base comprising the steps of pre-blending a hard elastomer and an elastomer plasticizer together in an elastomer/elastomer plasticizer pre-blend, pulverizing the elastomer/elastomer plasticizer pre-blend, and mixing the pulverized elastomer/elastomer plasticizer pre-blend with a particulated gum base softener; thereby forming a blend of particulated gum base ingredients.

In a twenty-sixth aspect, the invention is a particulated chewing gum base comprising a hard elastomer pulverized to less than 0.6 millimeters in size; a filler of less than 20 microns in size; and an elastomer plasticizer, the particulated gum base being a free-flowing mixture of gum base ingredients.

In a twenty-seventh aspect, the invention is a method of making a chewing gum composition comprising the steps of adding a premixed blend of particulated gum base ingredients including an elastomer, an elastomer plasticizer, a filler and a softener to a gum mixer; adding a powdered bulking agent to the gum mixer; adding a flavor to the gum mixer; and mixing the premixed blend of particulated gum base ingredients, powdered bulking agent and flavor to make the chewing gum composition.

In a twenty-eighth aspect, the invention is a free-flowing particulated gum base comprising particulated gum base ingredients of a size less than or equal to about 6 millimeters, the gum base being free of liquid ingredients and comprising a pulverized hard elastomer of less than 0.6 millimeters, a pulverized elastomer plasticizer, and softeners having a congealing point greater than 50°C (or 122° F).

In a twenty-ninth aspect, the invention is an intermediate ingredient for a particulated chewing gum base comprising a hard elastomer and an elastomer plasticizer; the hard elastomer and elastomer plasticizer being pre-blended into a homogeneous composition and then pulverized to a free-flowing powder having a particle size of less than 6 millimeters.

In a thirtieth aspect, the invention is a method of making a particulated chewing gum comprising the steps of a) pre-blending a hard elastomer and an elastomer plasticizer together into a pre-blend; b) pulverizing the

elastomer/elastomer plasticizer pre-blend; and c) mixing the pulverized elastomer/elastomer plasticizer pre-blend with a particulated gum base softener and a powdered bulk sweetener, thereby forming a blend of particulated chewing gum ingredients.

5           The particulated gum base of the present invention can be added as an initial ingredient to conventional chewing gum mixers in place of prior art chewing gum base. However, the particulated chewing gum base can be produced with less time and energy consumption than typical prior art gum bases. The preferred particulated gum base uses a novel intermediate  
10       compound. The preferred particulated gum base can also be used to make novel particulated chewing gum compositions, where one or more of the chewing gum ingredients is powder blended with the particulated chewing gum base.

15           These and other advantages of the invention will be best understood in view of the attached drawings.

#### BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

Figure 1 is a flow chart of the schematic drawing of a preferred process of making a gum base in particulate form according to the pilot plant of the present invention.

20           Figure 2 is a schematic drawing of a preferred process of making a gum base in particulate form according to the present invention.

Figure 3 is a schematic drawing of the mixtruder for use with the present invention.

25           Figure 4 is a schematic drawing of the steelbelt chiller used in a preferred process of the present invention.

Figure 5 is a schematic drawing of the granulator used in a preferred process of the present invention.

Figure 6 is a schematic drawing of the hammermill used in a preferred process of the present invention.

30           Figure 7 is a schematic drawing of the atomizer used in a preferred process of the present invention.

Figure 8 is a schematic drawing of the v-blender used in a preferred process of the present invention.

Figure 9 is a schematic drawing of a process of making a gum base in particulate form according to one aspect of the present invention.

5

## DETAILED DESCRIPTION OF THE INVENTION

As noted above, the present invention relates to a number of different aspects of gum base and chewing gum manufacturing. A common element of most of these aspects of the invention centers about a particulated chewing gum base. Some aspects of the invention deal with methods of preparing gum base ingredients so that they may be stored and/or blended in to a particulate blend gum base. Different pieces of equipment can be used to make the particulate material including a low-efficiency batch mixer, an atomizer or a continuous mixer. Other aspects of the invention involve such particulate blend gum bases themselves, such as ways to prevent them from agglomerating. Other aspects of the invention relate to benefits that come about from the use of particulate blend gum bases in making chewing gum.

10

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Unless noted otherwise, all percentages herein are by weight percent.

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The present invention is applicable to preparing a gum base and final gum products and can be used with either a batch-type system or a continuous extruder-type system. In the preferred embodiment of the present invention, however, and for ease in illustrating the present invention, it will be described herein with reference to its use in a partially-continuous gum base pilot plant, manufacturing process.

25

Schematic illustrations of the preferred process for making a particulated gum base and apparatus for use with the present invention are illustrated in FIGS. 1 – 9.

30

In general, a chewing gum composition typically comprises a water-soluble bulk portion, a water-insoluble chewable gum base portion and typically water-insoluble flavoring agents. The water-soluble portion dissipates with a portion of the flavoring agent over a period of time during chewing. The gum base portion is retained in the mouth throughout the chew.

With the present invention, some ingredients which are water soluble and are typically added during the gum manufacturing process may now be included as part of the gum base, as described in more detail hereafter.

The insoluble gum base generally comprises elastomers, resins, fats and oils, waxes, softeners and inorganic fillers. Elastomers may include polyisobutylene, isobutylene-isoprene copolymer and styrene butadiene elastomer, as well as natural latexes such as chicle. Resins include polyvinylacetate and terpene resins. Fats and oils may also be included in the gum base, including tallow, hydrogenated and partially hydrogenated vegetable oils, and cocoa butter. Commonly employed waxes include paraffin, microcrystalline and natural waxes such as beeswax and carnauba. According to the preferred embodiment of the present invention, the insoluble gum base constitutes between about 5% and about 95% by weight of the gum. More preferably the insoluble gum base comprises between about 10% and about 50% by weight of the gum, and most preferably between about 20% and about 45% by weight of the gum. When high levels of gum coatings are needed, gum base may comprise up to 95% of the gum center formula.

The gum base typically also includes a filler component. The filler component may be calcium carbonate, magnesium carbonate, talc, dicalcium phosphate or the like. The filler may constitute between about 5% and about 60% by weight of the gum base. Preferably, the filler comprises about 5% to about 50% by weight of the gum base.

Gum bases typically also contain softeners, including glycerol monostearate and glycerol triacetate. Further, gum bases may also contain optional ingredients such as antioxidants, colors, and emulsifiers. The present invention may be utilized to make gum bases having a wide variety of formulations. Indeed, it is believed that nearly all commercially acceptable chewing gum bases can be converted over and made according to the present invention.

The water-soluble portion of the chewing gum may further comprise softeners, sweeteners, flavoring agents and combinations thereof. Softeners are added to the chewing gum in order to optimize the chewability and mouth

feel of the gum. Softeners, also known in the art as plasticizers or plasticizing agents, generally constitute between about 0.5% and about 15% by weight of the chewing gum. Softeners contemplated by the present invention include glycerin, lecithin and combinations thereof. Further, aqueous sweetener solutions such as those containing sorbitol, hydrogenated starch hydrolyzates, corn syrup and combinations thereof may be used as softeners and binding agents in gum.

Sugar sweeteners generally include saccharide-containing components commonly known in the chewing gum art which comprise, but are not limited to, sucrose, dextrose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids and the like, alone or in any combination. Sugarless sweeteners include components with sweetening characteristics but which are devoid of the commonly known sugars and comprise, but are not limited to, sugar alcohols such as sorbitol, mannitol, xylitol, hydrogenated starch hydrolyzates, maltitol and the like, alone or in any combination.

A flavoring agent may also be present in the chewing gum in an amount within the range of from about 0.1% to about 10%, preferably from about 0.5% to about 5%, by weight of the gum. The flavoring agents may comprise essential oils, synthetic flavors, or mixtures thereof including, but not limited to oils derived from plants and fruits such as citrus oils, fruit essences, peppermint oil, spearmint oil, clove oil, oil of wintergreen, anise, and the like. Artificial flavoring components are also contemplated for use in gums of the present invention. Those skilled in the art will recognize that natural and artificial flavoring agents may be combined in any sensorally acceptable blend. All such flavors and flavor blends are contemplated by the present invention.

Optional ingredients such as colors, emulsifiers and other active agents may be added to the chewing gum.

In general, chewing gum is manufactured by sequentially adding the various chewing gum ingredients to a commercially available mixer known in the art. After the ingredients have been thoroughly mixed, the gum mass is



discharged from the mixer and shaped into the desired form such as extruding into chunks or casting into pellets, which are then coated or panned.

Heretofor, the ingredients were mixed by first melting the gum base and adding it to the running mixer. The base may also have been melted in the mixer itself. While gum bases of the present invention may be melted at the beginning of the chewing gum manufacturing process, improved gum making operations of the present invention contemplates being able to make the chewing gum without pre-melting the gum base. Color or emulsifiers may also be added after the gum base is added to the mixer. A softener such as glycerin may also be added at this time, along with syrup and a portion of the bulking agent. Other optional ingredients are added to the batch in a typical fashion, well known to those of ordinary skill in the art.

The entire mixing procedure typically takes from five to fifteen minutes, but longer mixing times may sometimes be required. Those skilled in the art will recognize that many variations of the above-described procedure may be followed.

Chewing gum may be used as a delivery mechanism for active agents. One potential problem with adding active agents to a gum formulation is that the active agent may be degraded by heat often encountered in the gum making operation. Also, the active agent may become associated with the gum base, and not released during chewing of the gum. To avoid this, the active agent may be added at the end of the gum mixing operation. However, thorough mixing is then harder to achieve. Utilizing the present invention it may be possible to add active agents into chewing gum without exposing the active agents to as high of a heat or as long of mixing times as is often used when making chewing gum from conventional gum base. Also, active agents may release from the gum base during chewing.

By the terms "active agent" the present invention refers to a compound that has a desired therapeutic or physiological effect once ingested and/or metabolized. The therapeutic effect may be one which decreases the growth of a xenobiotic or other gut flora or fauna, alters the activity of an enzyme, provides the physical relief from a malady (e.g., diminishes pain, acid reflux or

other discomfort), has an effect on the brain chemistry of molecules that determine mood and behavior. Of course these are just examples of what is intended by therapeutic effect. Those of skill in the art will readily recognize that a particular agent has or is associated with a given therapeutic effect.

5           The active agent may be any agent that is traditionally used as a medicament and lends itself to being administered through the oral cavity. Such active agents may be vitamins, chemotherapeutics; antimycotics; oral contraceptives, nicotine or nicotine replacement agents, minerals, analgesics, antacids, muscle relaxants, antihistamines, decongestants, anesthetics,  
10           antitussives, diuretics, anti-inflammatories, antibiotics, antivirals, psychotherapeutic agents, anti-diabetic agents and cardiovascular agents, nutraceuticals and nutritional supplements.

          Vitamins and co-enzymes that may be delivered using this invention include but are not limited to water or fat soluble vitamins such as thiamin,  
15           riboflavin, nicotinic acid, pyridoxine, pantothenic acid, biotin, flavin, choline, inositol and paraminobenzoic acid, carnitine, vitamin C, vitamin D and its analogs, vitamin A and the carotenoids, retinoic acid, vitamin E and vitamin K.

          Examples of chemotherapeutics agents include but are not limited to cisplatin (CDDP), procarbazine, mechlorethamine, cyclophosphamide,  
20           camptothecin, ifosfamide, melphalan, chlorambucil, bisulfan, nitrosurea, dactinomycin, daunorubicin, doxorubicin, bleomycin, plicomycin, mitomycin, etoposide (VP16), tamoxifen, taxol, transplatinum, 5-fluorouracil, vincristin, vinblastin and methotrexate or any analog or derivative variant thereof.

          Antimicrobial agents that may be used include but are not limited to nafcillin, oxacillin, vancomycin, clindamycin, erythromycin, trimethoprim-  
25           sulphamethoxazole, rifampin, ciprofloxacin, broad spectrum penicillin, amoxicillin, gentamicin, ceftriaxone, cefotaxime, chloramphenicol, clavunate, sulbactam, probenecid, doxycycline, spectinomycin, cefixime, penicillin G, minocycline,  $\beta$ -lactamase inhibitors; mezlocillin, piperacillin,  
30           aztreonam, norfloxacin, trimethoprim, ceftazidime, dapsone.

          Antifungal agents that may be delivered include but are not limited to ketoconazole, fluconazole, nystatin, itraconazole, clomitrazone, and

amphotericin B. Antiviral agents that may be used include but are not limited to acyclovir, trifluridine, idoxorudine, foscarnet, ganciclovir, zidovudine, dideoxycytosine, dideoxyinosine, stavudine, famciclovir, didanosine, zalcitabine, rifimantadine, and cytokines.

5           Antacids include cimetidine, ranitidine, nizatidine, famotidine, omeprazole, bismuth antacids, metronidazole antacids, tetracycline antacids, clarithromycin antacids, hydroxides of aluminum, magnesium, sodium bicarbonates, calcium bicarbonate and other carbonates, silicates, and phosphates.

10           Antihistamines are represented by but are not limited to cimetidine, ranitidine, diphenhydramine, prylamine, promethazine, chlorpheniramine, chlorcyclizine, terfenadine, carbinoxamine maleate, clemastine fumarate, diphenhydramine hydrochloride, dimenhydrinate, prilamine maleate, tripelennamine hydrochloride, tripelennamine citrate, chlorpheniramine  
15           maleate, brompheniramine maleate, hydroxyzine pamoate, hydroxyzine hydrochloride, cyclizine lactate, cyclizine hydrochloride, meclizine hydrochloride, acrivastine, cetirizine hydrochloride, astemizole, levocabastine hydrochloride, and loratadine.

            Decongestants and antitussives include agents such as  
20           dextromethorphan, levopropoxyphene napsylate, noscapine, carbetapentane, caramiphen, chlophedianol, pseudoephedrine hydrochloride, diphenhydramine, glaucine, pholcodine, and benzonatate.

            Anesthetics include etomidate, ketamine, propofol, and benodiazapines (e.g., chlordiazepoxide, diazepam, clorezebate, halazepam, flurazepam, quazepam, estazolam, triazolam, alprozolm, midazolam, temazepam, oxazepam, lorazepam), benzocaine, dyclonine, bupivacaine, etidocaine, lidocaine, mepivacaine, promoxine, prilocaine, procaine, proparcaine, ropivacaine, tetracaine. Other useful agents may include amobarbital, aprobarbital, butabarbital, butalbital mephobarbital, methohexital,  
25           pentobarbital, phenobarbital, secobarbital, thiopental, paral, chloral hydrate, ethchlorvynol, clutethimide, methprylon, ethinamate, and meprobamate.  
30

Analgesics, include opioids such as morphine, mepidine, dentanyl, sufentanil, alfentanil, aspirin, acetaminophen, ibuprofen, indomethacin, naproxen, atrin, isocome, midrin, axotal, firinal, phrenilin, ergot and ergot derivatives (wigraine, cafergot, ergostat, ergomar, dihydroergotamine),  
5 imitrex.

Diuretics include but are not limited to acetazolamide, dichlorphenamide, methazolamide, furosemide, bumetanide, ethacrynic acid torseimide, azosemide, muzolimine, piretanide, tripamide, bendroflumethiazide, benzthiazide, chlorothiazide, hydrochlorothiazide,  
10 hydroflumethiazide, methyclothiazide, polythiazide, trichlormethiazide, indapamide, metolazone, quinethazone, amiloride, triamterene, sprionolactone, canrenone, and potassium canrenoate.

Anti-inflammatories include but are not limited to salicylic acid derivatives (*e.g.* aspirin) paraminophenol derivative (*e.g.* acetaminophen)  
15 indole and indene acetic acids (indomethacin, sulindac and etodalac) heteroaryl acetic acids (tolmetin diclofenac and ketorolac) aryl propionic acid derivatives (ibuprofen, naproxen, ketoprofen, fenopren, oxaprozine), anthranilic acids (mefenamic acid, meclofenamic acid) enolic acids (piroxicam, tenoxicam, phenylbutazone and oxyphenthazone).

Psychotherapeutic agents include thorazine, serentil, mellaril, millazine, tindal, permitil, prolixin, trilafox, stelazine, suprazine, taractan, navan, clozaril, haldol, halperon, loxitane, moban, orap, risperdal, alprazolam, chlordiaepoxide, clonazepam, clonazepam, diazepam, halazepam, lorazepam, oxazepam, prazepam, buspirone, elvavil, anafranil, adapin, sinequan, tofranil,  
20 surmontil, asendin, norpramin, pefofrane, ludiomil, pamelor, vivactil, prozac, luvox, paxil, zoloft, effexor, wellbutrin, serzone, desyrel, nardil, parnate, eldepryl.

Cardiovascular agents include but are not limited to nitroglycerin, isosorbide dinitrate, sodium nitroprusside, captopril, enalapril, enalaprilat, quinapril, lisinopril, ramipril, losartan, amrinone, lirinone, vesnerinone,  
30 hydralazine, nicorandil, prozasin, doxazosin, bunazosin, tamulosin, yohimbine, propranolol, metoprolol, nadolol, atenolol, timolol, esmolol, pindolol,

acebutolol, labetalol, phentolamine, carvedilol, bucindolol, verapamil, nifedipine, amlodipine and dobutamine.

It is envisioned that depending on the active agent or medicament, the resultant chewing gum can be used to treat inter alia: coughs, colds, motion sickness; allergies; fevers; pain; inflammation; sore throats; cold sores; migraines; sinus problems; diarrhea; diabetes, gastritis; depression; anxiety, hypertension; angina and other maladies and symptoms. Also these gums may be useful in ameliorating cravings in substance abuse withdrawal.

Specific active agents or medicaments include by way of example and limitation: caffeine, aspirin, acetaminophen; ibuprofen; cimetidine, ranitidine, famotidine, dramamine, omeprazole, dyclonine, chlorpheniramine maleate, pseudoephedrine hydrochloride, dextromethorphan, benzocaine, naproxen, and nicotine.

Compositions that may be formulated into a suitable chewing gum formulation are described in, for examples, U.S. Patent No. 5,858,423; U.S. Patent No. 5,858,413; U.S. Patent No. 5,858,412 and U.S. Patent No. 5,858,383. Additionally, Goodman and Gilman's "The Pharmaceutical Basis of Therapeutics" (Eds. Hardman et al., Publ. McGraw Hill, NY) provides comprehensive guidance of useful drugs and their mechanisms of action. Medicated chewing gums have been particularly effective in the delivery of agents such as nicotine as described in for example, U.S. Patent No. 5,866,179; and U.S. Patent No. 5,889,028. U.S. Patent No. 5,846,557 describes general chewing gum compositions containing cough suppressing agents. These patents are incorporated herein by reference as providing a teaching of the incorporation of medicinal agents into oral chewable formulations.

Nutraceuticals and nutritional supplements may also be added to chewing gums as active agents. Among these are herbs and botanicals that include, but are not limited to capsicum, chamomile, cat's claw, echinacea, garlic, ginger, ginko, various ginseng, green tea, golden seal, kava kava, nettle, passion flower, saw palmetto, St. John's wort, and valerian. Also included are mineral supplements such as calcium, copper, iodine, iron,

magnesium, manganese, molybdenum, phosphorous, and selenium. Other nutraceuticals that also can be added to chewing gum as active agents are fructo-oligosaccharides, glucosamine, grapeseed extract, guarana, inulin, phytosterols, phytochemicals, isoflavones, lecithin, lycopene, oligofructose, polyphenol and psyllium as well as weight loss agents such as chromium picolinate and phenylpropanolamine.

Phytochemicals may also be added to chewing gums as active agents. Among these are adhatoda vasica, amla, andrographis paniculata, ashwagandha, asparagus racemosus, bacopa monnieri, piper boswellia serrata, calcium sennosides, capsaicin, centella asiatica, garcinia indica, coleus forskohlii, curcuma longa, trigonella foenum, ginger extract, green tea, commiphora mukul, gymnema sylvestre, inula racemosa, licorice, momordica charantia, morinda citrifolia, mucuna pruriens, neem leaf extract, olive leaf extract, phyllanthus amarus, picrorhiza kurroa, piper longum, rosemary extract, rubia cordifolia, saw palmetto, sida cordifolia, pterocarpus marsupium, soy isoflavones, terminalia arjuna, terminalia belerica, terminalia chebula, tinospora cordifolia, tribulus terrestris, trikatu, triphala, tulsi extract, tylophora, horse chestnut, yohimbe extract.

It should be understood that the chewing gum formulations of the present invention need not contain an active agent, and are not limited to the agents listed herein above. Any medicinal or other active agent that lends itself to ingestion may be formulated into the chewing gum formulations of the aspects of the present invention directed to the inclusion of active agents.

The insoluble portion of the gum typically may contain any combination of elastomers, vinyl polymers, elastomer plasticizers, fillers, softeners, waxes and other optional ingredients such as colorants and antioxidants.

The variety of gum base ingredients typically used provides the ability to modify the chewing characteristics of gums made from the gum base.

Elastomers provide the rubbery, cohesive nature to the gum, which varies depending on this ingredient's chemical structure and how it may be compounded with other ingredients.

Natural elastomers may include natural rubber such as smoked or liquid latex and guayule, natural gums such as jelutong, lechi caspi perillo, massaranduba balata, massaranduba chocolate, nispero, rosidinha, chicle, gutta percha, gutta kataiu, niger gutta, tenu, chilte, chiquibul, gutta hang kang.

5 Synthetic elastomers may include high molecular weight elastomers such as butadiene-styrene copolymers and isobutylene-isoprene copolymers, low to high molecular weight elastomers such as polybutadiene and polyisobutylene, vinyl polymeric elastomers such as polyvinyl acetate, polyethylene, vinyl copolymeric elastomers such as vinyl acetate/vinyl laurate, vinyl acetate/vinyl stearate, ethylene/vinyl acetate, polyvinyl alcohol or mixtures thereof.

10 Hard elastomers are elastomers that have Mooney viscosities of greater than 30. Common hard elastomers include isoprene-isobutylene elastomer, often called butyl elastomer; butadiene-styrene type elastomer, often called SBR; and polyisobutylene (PIB) elastomers of average GPC molecular weights greater than 75,000.

Butadiene-styrene type elastomers typically are copolymers of from about 20:80 to 60:40 styrene:butadiene monomers. The ratio of these monomers effects the elasticity of the SBR as evaluated as Mooney viscosity. As the styrene: butadiene ratio decreases, the Mooney viscosity decreases.

20 Typical Mooney viscosities for these elastomers are from about 40 to 80 ML1 + 3 @ 210° F.

Isobutylene-isoprene type elastomers have molar percent levels of isoprene ranging from 0.2 to 4.0. Typical Mooney viscosities for these elastomers range from 30 to 75 ML1+8 @ 250° F. The average molecular weights of these elastomers may range from 200,000 to 1,000,000.

The structure of SBR typically consists of straight chain 1,3-butadiene copolymerized with phenylethylene (styrene). The structure of butyl elastomer typically consists of branched 2-methyl-1,3-butadiene (isoprene) copolymerized with 2-methylpropene (isobutylene).

30 Polyisobutylene type elastomers are polymers of 2-methylpropene. These elastomers provide soft chew characteristics to the gum base and still provide the elastic qualities, as do the other elastomers. Average molecular

weights may range from about 30,000 to 120,000. PIB having GPC average molecular weights greater than and equal to 75,000, for the purpose of the present invention, are hard elastomers. Those PIB's with GPC average MW less than 75,000 are, for the purposes of the present invention, soft elastomers.

Polybutenes range in average molecular weights from about 5,000 to less than about 30,000.

Vinyl polymeric and copolymeric type elastomers provide tack resistance, vary the chew characteristics of gums made from these bases and offer hydrophilic properties beneficial to sensory perception of the final gums.

For copolymeric types, the amount of vinyl laurate, vinyl stearate, or ethylene present in the vinyl laurate/vinyl acetate (VL/VA), vinyl stearate/vinyl acetate (VS/VA), or ethylene/vinyl acetate (EVA) copolymers respectively typically ranges from about 10 to about 60 percent by weight of the copolymer. Average molecular weights of these polymers may range from about 2,000 to about 80,000. Ball and ring softening points of these polymers may range from about 50 to 120° C. Polyvinyl acetate having an average molecular weight from about 8,000 to about 52,000 are preferred for use in the gum base and gum of the present invention. More preferred for chewing gum bases are those of from about 10,000 to about 35,000 molecular weight, and for bubble gum bases, those having from about 30,000 to about 60,000 molecular weight.

Vinyl polymers typically release flavor quickly, and using iso-alkanic waxes exhibiting small crystalline structure with these vinyl polymers extends flavor release.

Petroleum waxes aid in the curing of the finished gum made from the gum base as well as improve shelf-life and texture. Wax crystal size when hard also improves the release of flavor. Those waxes high in iso-alkanes have a smaller crystal size than those waxes high in normal-alkanes, especially those with normal-alkanes of carbon numbers less than 30. The smaller crystal size allows slower release of flavor since there is more



hindrance of the flavor's escape from this wax versus a wax having larger crystal sizes.

Fats may be selected from the group comprising fully saturated oils that contain, as one or more of their constituent groups, fatty acids of carbon chain length of from 6 to 18 and triglycerides having a total summated saturated caprioic, caprylic, capric, lauric, myristic and palmitic fatty acid content of from about 8 to about 60 percent by weight of the fatty acids, determined from the fatty acid methyl ester distribution by gas chromatography.

Waxes may be selected from the group consisting of petroleum waxes containing predominantly iso-alkanes and normal alkanes having a carbon chain lengths greater than about 30, and synthetic waxes.

Synthetic waxes are produced by means atypical of petroleum wax production. The synthetic waxes may include waxes containing branched alkanes and copolymerized with monomers such as, but not limited to, propylene and polyethylene and Fischer-Tropsch type waxes. Polyethylene wax is not in the same category as polyethylene, a polymer of ethylene monomers.

Elastomer plasticizers vary the firmness of the gum base. Their specificity on elastomer inter-molecular chain breaking (plasticizing) along with their varying softening points cause varying degrees of finished gum firmness when used in base. This is also important when one wishes to provide more elastomeric chain exposure to the alkanic chains of the waxes.

Elastomer plasticizers include natural rosin esters such as glycerol ester of partially hydrogenated rosin, glycerol ester of polymerized rosin, glycerol ester of partially dimerized rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, pentaerythritol esters of partially hydrogenated rosin, partially hydrogenated methyl esters of rosin, pentaerythritol ester of rosin, synthetic elastomer plasticizers such as terpene resins derived from alpha-pinene, beta-pinene and/or d-limonene, and mixtures thereof.

The elastomer plasticizers used may be of one type or of combinations of more than one. Typically, the ratios of one to the other are dependent on each respective softening point, on each effect on flavor release, and on each

respective degree of tack they cause to the gum. Ball and ring softening points of the rosin ester types described above may range from about 60 to about 120° C. Softening points of the terpene resins may range from about 60 to about 130° C and an average molecular weight of from about 500 to 2,000.

Occasionally, both terpene and rosin ester resins may be used in the present invention. The terpene: rosin ester ratios may range from about 1:15 to about 15:1.

Softeners modify the texture, cause the hydrophobic and hydrophilic components of the base to be miscible, and may further plasticize the synthetic elastomers of the gum base. Softeners include fully hydrogenated oils of cottonseed, soybean, palm, palm kernel, coconut, safflower and the like, as well as monoglycerides, diglycerides, acetylated monoglycerides, distilled mono- and diglycerides and de-oiled or "powdered" lecithin. The glycerides and lecithin are sometimes referred to as emulsifiers.

Fillers used in gum base modify the texture of the gum base and aid in processing. Fillers include carbonate or precipitated carbonated types such as magnesium and calcium carbonate, ground limestone and silicate types such as magnesium and aluminum silicate, clay, alumina, talc, as well as titanium oxide, mono- di- and tricalcium phosphate, cellulose polymers such as ethyl, methyl and wood or mixtures thereof.

Other optional ingredients such as antioxidants and colorants may also be used in the gum base.

Antioxidants prolong shelf-life and storage of gum base, finished gum or their respective components including fats and flavor oils. Antioxidants suitable for use in gum base or gum of the present invention include butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), beta -carotenes, tocopherols, acidulants such as Vitamin C, propyl gallate, other synthetic and nature types or mixtures thereof in free-flowing ground or pulverized form.

Flavorants and colorants impart characteristics or remove or mask undesired characteristics. Colorants and flavorants include FD&C type lakes,

plant extracts, fruit and vegetable extracts, titanium dioxide, cocoa powder or mixtures thereof in free-flowing ground or pulverized form.

#### THE PREFERRED PARTICULATED GUM BASE

The preferred ingredients and the preferred ranges in the particulate blend gum base of the present invention are as follows.

Elastomers in the amount of about 0 to about 30% by weight of the final particulate blend gum base are acceptable. The preferred elastomers for use in the present invention include styrene-butadiene elastomer, isoprene-isobutylene copolymer, hard polyisobutylene ( $M_w > 75,000$ ), and soft polyisobutylene.

When present, vinyl polymeric elastomers comprise about 0 to about 65% by weight of the final particulate blend gum base. The preferred vinyl polymers for use in the present invention include polyvinyl acetate having a GPC average molecular weight from about 8,000 to about 65,000. More preferred are those having an average molecular weight of from about 10,000 to about 59,000.

Elastomer plasticizers in the amount of about 0 to about 45% by weight of the final particulate blend gum base are acceptable. The preferred elastomer plasticizers used in the present invention are natural rosin esters such as glycerol ester of partially hydrogenated rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, partially hydrogenated methyl esters of rosin, synthetic elastomer plasticizers such as terpene resins, and mixtures thereof.

More preferably, the elastomer plasticizers used are glycerol ester of partially hydrogenated rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, synthetic elastomer plasticizers such as terpene resins derived from alpha-pinene, beta-pinene and/or d-limonene, and mixtures thereof.

Softeners include emulsifiers, acetylated monoglycerides, medium chain triglycerides, glycerol triacetate, waxes and fats.

Emulsifier softeners present in the amount of about 0 to about 30% by weight of the final particulate blend gum base are acceptable. The preferred emulsifiers include vegetable oil lecithin, de-oiled lecithin, glycerol monostearate, acetylated lecithin, and the like, and mixtures thereof.

Acetylated monoglycerides, glycerol triacetate, medium chained triglyceride softeners present in the amount of 0 to about 6% by weight of the final particulate blend gum base are effective plasticizers of the polyvinyl acetate polymer. Also, glycerol monostearate present in the amount of 0 to about 10% by weight of the final particulate blend gum base is acceptable.

Waxes in the amount of about 0 to about 40% by weight of the final particulate blend gum base are acceptable. The preferred waxes include petroleum waxes, synthetic waxes, microcrystalline waxes, paraffin waxes, natural waxes such as caruba, beeswax and the like, and mixtures thereof.

Fats in the amount of about 0 to about 45% by weight of the final particulate blend gum base are acceptable. The preferred fats include fully hydrogenated and partially hydrogenated fats and mixtures thereof.

Fillers in the amount of 0 to about 70% by weight of the final particulate blend gum base are acceptable. The preferred fillers include calcium carbonate, ground limestone, talc, mono-, di- and tricalcium phosphate, zirconium silicate, or mixtures thereof. More preferably, the fillers used have a mean particle size range from about 0.4 to about 14 microns and are calcium carbonate and talc.

While the particle size of the hard elastomer and filler are most important, other gum base ingredients that will eventually melt when made into chewing gum, such as fats and wax, need to be sized so that they form a homogeneous mix that does not allow ingredients to settle out during transportation. The maximum particle sizes in the gum base should typically be less than 6 millimeters, more preferably less than about 3 millimeters, more preferably less than about 1 millimeter, more preferably less than 0.6 millimeters, and most preferably less than about 425 microns. Preferably, all of the particulated gum base ingredients will have a small particle size. The gum base will be more easily manufactured into chewing gum the smaller the size of the particulated ingredients. Therefore, it would be preferable to make the ingredients into as small of a size as possible. Particle size as used herein and in the claims is determined by a sieve analysis. For example,

particles of 0.600 millimeters or less will pass through a sieve having openings 0.601 millimeters square.

#### METHODS OF MAKING A PARTICULATE BLEND GUM BASE

One aspect of the present invention includes aspects drawn to a method of making a particulate blend gum base from a plurality of gum base ingredients in particulate form. The gum base ingredients are blended to form a particulate blend gum base.

Optionally, an anti-caking agent can be added to the particulate blend gum base to prevent agglomeration. Anti-caking agents can comprise fillers, bulk sweeteners, high-intensity sweeteners, glycerol monostearate, elastomer plasticizers, fused silica and mixtures thereof.

Optionally, the gum bases of the present invention can be used to make gum products that can be tableted in a tableting press to form a tableted gum products.

A flow chart illustrating the basic processing steps of a pilot plant used to prepare particulate blend gum bases of the present invention is shown in FIG. 1. A schematic illustration of the pilot plant apparatus and system of the present invention is shown in FIG. 2 and referred to by the reference numeral 10.

A preferred mixing and extruding apparatus is illustrated in FIG. 3. A mixtruder 30 comprises a double blade mixer and an extruder located below the mixer. Ingredients are added to the mixer through the mixer lid 31. Two blade shafts 32 drive the mixer blades (not shown). The mixer is jacketed and heat is supplied to the walls of the mixer with hot oil. The extruder is located within an extruder housing 33. The extruder is also jacketed and heated with hot oil. A temperature sensor 34 monitors the temperature of the extruder housing jacket. The mixtruder further comprises an electrical panel 35 that provides a digital read out of the temperature of the mixer jacket (not shown), the internal temperature of the mixer (not shown) and the temperature of the extruder housing jacket (not shown). The extrudate is discharged from the extruder through a T-bar manifold 36 having a plurality of holes (not shown) onto the cooling belt 40 depicted in FIG. 4.

A preferred cooling mechanism is depicted in FIG. 4. The steel belt chiller 40 comprises a cooling belt 41, which is driven by a cooling belt driving drum 42, a belt motor 43 and a belt sprocket 44. The cooling belt 41 comprises an upper side 45 and an underside (not shown). The cooling belt 41 rides over a collection trough (not shown). A cooling feed-line 46 supplies ice cold water to the underside of the cooling belt, which is sprayed through nozzles (not shown) along the under side of the cooling belt. The collecting trough collects the water after it is sprayed out of the nozzles onto the underside of the cooling belt. The collected water is re-circulated to the chiller (not shown) where it is re-chilled. Extrudate is extruded from the mixtruder 30 through the holes of the T-bar manifold 36 in the form of strands (not shown). As the strands of extrudate travel along the cooling belt 41 from the mixtruder 30 towards the granulator 50 they are chilled and become hard and brittle. Preferably, the extrudate is sufficiently chilled such that it does not stick to the belt. At the top of the cooling belt driving drum 42, a belt cleaner blade (not shown) scrapes any extrudate that adheres to the cooling belt 41. The strands of chilled extrudate fall off the end 48 of the cooling belt 41 and into a granulator chimney 51 of the granulator 50 depicted in FIG. 5.

Preferred cutting and grinding mechanisms are depicted in FIGS. 5 and 6, respectively. As depicted in FIG. 5, the granulator 50 comprises a granulator chimney 51 and a granulator kettle 52, which house the granulator blades (not shown). The granulated extrudate (not shown) falls onto a conveyor belt 53, which conveys the granulated extrudate to the hammermill 60 depicted in FIG. 6.

As illustrated in FIG. 6, the hammermill 60 includes a hopper 61 and a hammermill housing 62, which houses the hammers (not shown). Liquid nitrogen is supplied through a feed line 63 to the hammermill housing 62 to cool the hammers (not shown). The conveyor belt 53 conveys the granulated extrudate to the hopper 61. The hopper feeds the granulated extrudate to the hammers where it is pulverized to a fine powder (not shown). A chute 64

guides the fine powder into a collection drum 65. Preferably, the hammermill includes a dust bag 66 to collect air borne particles.

A preferred spray congealing mechanism is shown in FIG. 7. The spray congealing apparatus 70 includes a heated tank 71, a feed line 72, a spray nozzle 73, a cooling environment 74 and a collector 75. A molten mixture is feed from the heated tank 71 through the feed line 72 to the spray nozzle 73. As the molten mixture is sprayed into the cooling environment 74, the droplets (not shown) solidify and are collected by the collector 75.

A preferred powder blender is illustrated in FIG. 8. The v-blender 80 comprises hinged feed hatches 81, a pivot rod 82, a chain driven motor 83, sprockets 84, a slide gate 85, a discharge valve 86, and legs 87. Gum ingredients are feed into the v-blender 80 through hinged feed hatches 81. The v-blender 80 is rotated about a pivot rod 82, which is driven by a chain driven motor 83 and sprockets 84. After blending is complete, the slide gate 85 is opened and the gum product (not shown) is discharged from the discharge valve 86.

An alternate process of making a particulated gum base according to one aspect of the present invention is depicted in FIG. 9. Although not depicted in the Figures, the process of the present invention further includes a dust collection system.

Much of the equipment and process steps described below are based on pilot-plant scale developments. However, a person of ordinary skill in the art will recognize how the equipment and processes could be scaled up for commercial practice of the invention.

#### Grinding

One aspect of the present invention is drawn to a method of making a particulate blend gum base comprising a gum base ingredient, or a combination of gum base ingredients, that have been particulated by grinding.

Particle size reduction, herein referred to as "grinding" or "pulverizing," is used to prepare ingredients for use in the present invention. This grinding or pulverizing is accomplished by those knowledgeable in the art of doing this and the act or process of pulverizing or grinding these ingredients is described

herein as examples of a typical process and is in no way meant to limit the scope of the claims of this invention.

Typical pulverizing or grinding begins by first course grinding bulk gum base ingredients followed by fine grinding. Shredders, pulverizers, grinders, etc. are typically used to do this. Preferably, the pulverizing process is done under cool environments, not excluding cryogenic pulverizing. These terms are familiar to those knowledgeable in this art. The maximum particle sizes in the gum base should typically be less than 6 millimeters, and preferably less than 3 millimeters. It is preferred to pulverize the gum base ingredients to a size of 1 millimeter or less, more preferably to a size of 0.6 millimeters or less, and most preferably to a size of about 425 microns or less.

Ingredients suitable for grinding in the particulated gum base of the preferred embodiment of the invention are those that remain solid at ambient or room temperatures. This may be determined, and not meant to limit the scope of the present invention, to be around 75° F. Capillary and congealing melting points of the fats and softeners are preferably greater than or equal to about 50° C (or 122° F), which typically would result in fats remaining solid at around 75° F or lower.

Liquid ingredients by themselves are not present in the preferred particulated gum base of the present invention to a functional degree. By functional degree it is meant that the level of liquid ingredients present in the particulated gum base will not appreciatively cause the pulverized ingredients or the final inventive gum base from re-agglomerating or have reduced free-flowing particulate dry form. By free-flowing it is meant that the particulated gum base may be poured from a container at a relatively even flow rate, as opposed to coming out of the container in large clumps. It is obvious that small amounts of liquids such as emulsifiers and softeners, when mixed with other ingredients such as fillers, may result in these liquid ingredients to be able to present in the invention. The act of doing this is in no way meant to avoid the scope of the present invention.

High viscosity gum base ingredients can be individually particulated by grinding. As used herein the term "high viscosity gum base ingredient" refers



to a gum base ingredient that cannot be spray congealed as described using the pilot plant equipment described herein. These ground gum base ingredients can then be blended with other gum base ingredients to form the particulate blend gum base of the invention.

5           The grinding of the fats and glycerides further than their typical solid form received in is preferred. These ingredients may be added in flaked form, if the customer so desires. Addition, to the inventive gum base, of these and other ingredients in flaked form in no way avoids the scope of the present invention.

10           No grinding is typically required for fillers since they are usually supplied in fine particulate form. Particle size has an effect on cohesiveness, density and processing characteristics of the gum base and its compounding. The smaller the particle size, the more dense and cohesive the final gum base is. Also, by selecting fillers based on their particle size distribution, initial  
15           mass compounding may be varied, thus allowing alteration of the compounding characteristics of the initial mass during gum base processing and ultimately the final chew characteristics of gums made from these gum bases.

20           Talc filler may be used in the gum base and gum of the present invention that may come in contact with or employ acid flavors or provide an acidic environment needed to prevent degradation of an artificial sweetener by reacting with calcium carbonate type fillers. Mean particle size for calcium carbonate and talc fillers of the present invention are preferably less than 20 microns, and more preferably may range from about 0.1 micron to about  
25           15 microns, and most preferably are between about 2 and 10 microns in size.

          Preferably, the fillers used in the gum base and gum of the present invention are calcium carbonate, ground limestone, talc, mono-, di- and tricalcium phosphate, zirconium silicate, or mixtures thereof.

30           More preferably, the fillers used have a mean particle size range from about 0.4 to about 14 microns and are calcium carbonate and talc.

          Optionally, the inventive gum base is free of filler, allowing the user to add the desired type and amount of filler, tailored to his needs.

If required, ingredients capable of preventing already pulverized ingredients stored individually from re-agglomerating may be used. Fillers, rosin esters, terpene resins, synthetic waxes, and fats that are ground, or optionally added in a flaked form in the case of fats and softeners, are examples of ingredients able to keep the individually ground or pulverized gum base ingredients as well as the inventive gum base from re-agglomerating and in a free-flowing form.

Cold storage also is helpful, along with agitation of the ground material during storage. Preferably, the ingredients are immediately admixed into a final particulated gum base and packaged.

Transfer of the particulated gum base is achieved by means typically known in the art and is not included in the scope of the present invention. Any typical means can be used, as long as the environment is suitable to keep the particulated ingredients from re-agglomerating, such as in the absence of excessive heat, excessive moisture, low agitation and excessive pressure. An example of possible transfer of the ingredients is by way of pneumatic conveyers.

#### "Mixtruding"

It is costly to grind some ingredients, and very costly to grind hard elastomers to very small size particles. Further, certain gum base ingredients do not retain a particulated, free-flowing form if they are stored at room temperature for prolonged periods of time. Such gum base ingredients may be identified, without limiting the scope of the present invention, as having a softening point of less than about 130° F. These materials can be put in particulate form by a process referred to hereinafter as "mixtruding."

One aspect of the present invention overcomes such problems by combining at least one first gum base ingredients having a softening point of less than about 130° F and a second gum base ingredient to form a combined ingredient to form a combined ingredient having a high viscosity. Preferably, the combined ingredient has a softening point intermediate of the softening points of the first and second gum base ingredients.

In addition to processing gum base ingredient having a softening point of less than about 130° F, the mixtruder can be used to process combinations of hard or soft elastomers and elastomer plasticizers, or combinations of soft elastomers and polyvinyl acetates. Preferably, the soft elastomer is selected from the group consisting of polybutenes having an average molecular weight from about 5,000 to less than about 30,000, polyisobutylenes having an average molecular weight from about 30,000 to less than about 75,000 and mixtures thereof.

In a preferred method of the present invention, the first ingredient is selected from the group consisting of elastomer plasticizers, softeners, emulsifiers, fats, waxes, liquid gum base ingredients, flavor oils, and combinations thereof and the second gum base ingredient is selected from the group consisting of hard elastomers, soft elastomers, vinyl polymer elastomers, fillers and combinations thereof.

In general, the first ingredient and the second ingredient are added to a mixer, melted and blended to form a molten mixture. Preferably, the molten mixture is homogeneously mixed. The molten mixture is then extruded through an extruder of the type AMK/Ross SS Kneader Extruder 15 Gallon sigma blade type VIV GOL. Most preferably, the mixing apparatus and the extruding apparatus are combined to form a mixtruder 30 having the mixtruder configuration of FIG. 3. Thereafter, the extrudate is cooled by any of various of methods know to those knowledgeable in the art. Preferably, the extrudate is conveyed along a steelbelt chiller 40 of the type SANDVIK 20 inch wide SS cooling belt to form a solid mixture. The steelbelt chiller 40 is cooled by, for example, water having a temperature of between about 40° F to about 70° F. When greater cooling rates are desired, a glycol chilled cooling belt may be used.

At this point, the solid mixture is hard, brittle and easily ground into a particulated, free-flowing form. Preferably, the solid mixture is first size reduced in a granulator 50 and subsequently pulverized in a hammermill 60 of the type Mikro Pulverizer 3TH SS 30 horsepower to form a solid mixture in a particulated state. This combined ingredient can be blended, at a

temperature between about 40° F to about 90° F, more preferably between about 50° F and about 75° F, with other gum base ingredients to form the particulate blend gum base of the invention.

Most preferably, the first ingredient is an elastomer plasticizer and the second ingredient is a hard elastomer. Alternatively, the first ingredient is an elastomer plasticizer and the second ingredient is a soft elastomer. In some instances, the second ingredient is used to encapsulate the first ingredient.

This process of mixtruding elastomer plasticizers and elastomers to form an elastomer/elastomer plasticizer preblend facilitates the grinding of elastomers and elastomer plasticizers that have not been practical to grind, until presently. Unlike the manufacture of conventional gum base, the elastomer plasticizers/elastomer preblend is not compounded. Instead, the elastomer plasticizer sufficiently softens the elastomer to obtain a homogeneous mixture by melting the elastomers and elastomer plasticizers at a temperature of about 150° F to about 250° F and blending the molten preblend in a mixer having a mixer speed of about 252 rpm. This contrasts with the extended running time of typical gum base processing that is necessary to break down, or compound, the molecular weights of the elastomer as in the manufacture of conventional gum base. Any remaining amount of elastomer plasticizer can be preground and added separately. Alternatively, all of the elastomer plasticizer can be added to the elastomer/elastomer plasticizer preblend.

#### Spray Congealing

One aspect of the present invention is drawn to a method of making a particulate blend gum base comprising a gum base ingredient, or a combination of gum base ingredients, that have been particulated by spray congealing. Spray congealing refers to the process of solidifying atomized molten droplets of gum base ingredients. This is typically done by spraying the droplets through a high-pressure spray nozzle into a cooling environment. A preferred spray congealing apparatus 70 is illustrated in FIG. 7. The preferred spray congealing apparatus includes a heated tank 71, a feed line

72, a spray nozzle 73, a cooling environment 74 and a collector 75. Adjusting the pressure and the temperature of the molten gum base ingredient(s) controls the particle size of the spray.

Some gum base ingredients can be spray congealed by themselves to form particles of a desired size that will stay free flowing when used in the gum base of the present invention. Other gum base ingredients will need to be mixed with higher melting point ingredients to be spray congealed to form an ingredient to be used in a particulate gum base. Still other ingredients, especially those used in small quantities, may be mixed in a spray congealing system to obtain more uniform dispersion in a particulate blend gum base. Other gum base ingredients that are too viscous to be practically spray congealed by themselves may be mixed with other gum base ingredients so that the combined ingredients have a viscosity low enough to be pumped through an atomizing nozzle. For pilot plant scale equipment, a viscosity of about 80,000 centipoises at 250° F is near the practical limits for spraying. Of course other atomizing equipment or techniques may allow spray congealing of more viscous materials or blends of materials.

Gum base ingredients that may be treated by spray congealing include low viscosity gum base ingredients, gum base ingredients having a softening point of less than about 130° F, gum base ingredients that are liquid at about 75° F or lower, and gum base ingredients having capillary and congealing melting points less than 50° C (or 122° F). More preferably, gum base ingredients suitable to be particulated by spray congealing include fats, waxes, elastomer plasticizers, softeners, emulsifiers, liquid gum base ingredients, flavor oils, antioxidants, powdered flavoring agents, active agents, high intensity sweeteners, and combinations thereof. Liquid gum base ingredients include vegetable oil lecithin, glycerol triacetate, actelated monoglycerides, medium chain triglycerides and vegetable oils.

Low viscosity gum base ingredients can be particulated by spray congealing.

Alternatively, a low viscosity gum base ingredient can be blended with a high viscosity gum base ingredient and then can be particulated in a

combined form by spray congealing to form a solid mixture in a particulated state.

Alternatively, a gum base ingredient can be melted and spray congealed to form a solid particulated gum base ingredient. Preferably, the gum base ingredient that is melted is selected from the group consisting of elastomer plasticizers, microcrystalline and paraffin waxes, fully hydrogenated fats and emulsifiers. A second ingredient can be mixed into the melted gum base ingredient before spray congealing the melted gum base ingredient. The second ingredient can be a gum base ingredient or a chewing gum ingredient. Alternatively, the second ingredient can be an active agent.

Further, powdered ingredients having a particle size less than about 0.6 millimeters, such as powdered flavoring agents, high intensity sweeteners, bulk sweeteners, de-oiled lecithins, active agents, such as pharmaceuticals, nutraceuticals, probiotics, phytochemicals and the like, can be blended with the blend of molten ingredients to form a combined ingredient having a viscosity greater than about 80,000 centipoises at 250° F, and then atomized to form a particulated, free-flowing blend.

In one embodiment, at least one first gum base ingredient having a softening point of less than about 130° F is combined with a second gum base ingredient and spray congealed to form a particulated combined ingredient. Preferably, the first ingredient having a softening point of less than about 130° F is selected from the group consisting of fats waxes, emulsifiers, softeners, liquid gum base ingredients, flavor oils, and combinations thereof and the second ingredient is selected from the group consisting of antioxidants, powdered flavoring agents, active agents and combinations thereof.

Alternatively, at least one first gum base ingredient having a softening point greater than 130° F is combined with a second gum base ingredient and spray congealed to form a particulated combined ingredient. Preferably, the first ingredient having a softening point greater than 130° F. is selected from the group consisting elastomer plasticizers, hydrogenated fats, waxes and emulsifiers, each having a softening point of greater than 130° F. Preferably,

the second gum base ingredient has a softening point of less than 130° F. Alternatively, the second ingredient is a liquid at 75° F. Alternatively, the second ingredient is a solid particle with a particle size of 0.6 millimeters or less. Preferably, the second gum ingredient is selected from the group consisting of active agents, powdered flavoring agents, high intensity sweeteners and de-oiled lecithins.

Alternatively, a first gum base ingredient having a viscosity greater than about 80,000 centipoises at 250° F and a second gum base ingredient are blended together in a liquid form to form combined ingredient having a viscosity of less than about 80,000 centipoises at about 250° F. The combined ingredient is spray congealed to form a particulated combined ingredient. Preferably, the first gum base ingredient is a polyvinyl acetate having a molecular weight greater than 5,000. Preferably, the second gum base ingredient has a softening point of less than 130° F. Alternatively, the second ingredient is a liquid at 75° F. Alternatively, the second ingredient is a solid particle with a particle size of 0.6 millimeters or less. Preferably, the second gum ingredient is selected from the group consisting of active agents, powdered flavoring agents, high intensity sweeteners and de-oiled lecithins.

For atomizing blends of particulated ingredients and liquid ingredients with base ingredients having viscosities greater than about 80,000 centipoises at 250° F, the temperature of blending is dependant on the stability and volatility of the particulated and liquid ingredients. The temperature should be suitable to maintain the integrity and reduce the volatilization of these ingredients as much as possible, and still be within the atomization temperature ranges as set forth in the invention. The particle size of the particulated ingredients is less than 0.6 microns.

Typically, liquid ingredients can be blended with appropriate viscosity ingredients in the range of 0.1 to about 40 percent by weight of the total blending batch. Preferably, the range is from about 0.1 to about 35 percent.

For particulated ingredients, typically the range is from about 0.1 to about 45 percent by weight, and preferably from about 0.1 to about 35 percent.

In the preferred embodiment, the spray nozzle 73 comprises a NORDSON H20T single module heat melt gun having a No. 25 nozzle restricting plate. The air pressure supplied to the spray nozzle is about 80 psi. It is important to note that the type of spray nozzle used and the pressure supplied to the spray nozzle determines the viscosity at which an ingredient, or a combination of ingredients, can be spray congealed. An ingredient (or a combination of ingredients) having a viscosity less than about 80,000 centipoises at 250° F can be spray congealed using the preferred spray congealing apparatus of the present invention. As used herein, the term "low viscosity gum base ingredient" refers to a gum base ingredient having a viscosity less than about 80,000 centipoises at about 250° F. Although these viscosities are preferred, other spray congealing equipment may be used to spray congeal more viscous material. Preferably, the first and second ingredients are melted to form a homogeneous mixture. This mixture is then blended with or is melted in the presence of at least one ingredient such that the combined ingredient can be particulated by spray congealing. Most preferably, the first and second ingredients are melted in a mixer (not shown) to form a homogeneous mixture. The homogeneous mixture is fed from a heated tank 71 through a feed-line 72 to a high-pressure spray nozzle 73. Spraying, or atomizing; the molten gum base mixture into a cooling environment 74), having a temperature of about minus 19° F to about 75° F, causes the droplets of molten gum base mixture (not shown) to solidify to form a combined ingredient having a particulated, free-flowing form, which is collected by collector 75.

Optionally, an anti-caking agent can be added to the particulated solid mixture as it is being collected. Preferably, the anti-caking agent is selected from the group consisting of fillers, bulk sweeteners, glycerol monostearate and elastomer plasticizers, fused silica and mixtures thereof. Preferably, the anti-caking agent is added at a level of between about 0.5% and about 80% of the total weight of the ingredient.

The particulated gum base ingredient can then be blended with other gum base ingredients to form the particulate blend gum base of the invention.



### Particle Blending

After the gum base ingredients have been put in powder form by grinding, mixtruding and grinding, and/or spray congealing, a plurality of particulated gum base ingredients can be blended to form the particulate blend gum base of the present invention.

In general, a plurality of particulated gum base ingredients is supplied to a powder blender. Preferably, the blender has a temperature of about 50° F to about 75° F and a blender speed of about 10 rpm to about 30 rpm. Most preferably, the blender is a v-blender 80 familiar to those in the art of blending particulated ingredients, having the v-blender configuration illustrated in FIGS. 2 and 8. The particulated gum base ingredients are blended for a blending time of about 3 to about 60 minutes, more preferably about 5 to about 15 minutes, and most preferably about 10 minutes or less, to form the particulate blend gum base of the present invention.

Optionally, an anti-caking agent can be added to the plurality of particulated gum base ingredients

### Gum Manufacture

Although the present invention is described herein with reference to its use in the manufacture of a gum base, those knowledgeable in this art will recognize that the present invention also relates to the manufacture of a chewing gum composition.

In general, a plurality of particulated gum base ingredients is added to a sigma-blade, steam jacketed gum mixer as a particulate blend. The gum mixer can be a low efficiency mixer or a continuous mixer. The initial kettle temperature of the gum mixer is preferably between about 68° F to about 104° F. Additional gum ingredients are added to the mixer and the combination of the particulated gum base ingredients and additional gum ingredients in the gum mixer are mixed to form a gum composition.

The combination of the particulated gum base ingredients and the gum ingredients can be added at the same time to the mixer. The gum composition can be manufactured continuously or in batches.

Preferably, the blend of the particulated gum base ingredients is prepared at the same facility as where the blend is used.

Preferably, the particulated gum base ingredients and additional gum ingredients are mixed for a mixing time of about 10 minutes or less to form the gum composition of the present invention.

Certain aspects of the invention are described in detail by the non-limiting Examples set forth below. These Examples are presented to exemplify certain embodiments of the present invention and in no way are presented to limit the scope of the present invention. Comparative Examples describing the manufacture of conventional gum base formulations are also set forth below. Unless stated otherwise, all percentages are based on weight.

Examples of elastomer/elastomer plasticizer pre-blends are shown in Table 1. Examples 1-24 of elastomer/elastomer plasticizer pre-blends are shown in Table 2.

TABLE 1

	Percent	
	Minimum	Maximum
Hard Elastomer	20	80
SBR	0	80
Butyl Rubber	0	80
Soft Elastomer	0	30
Polyisobutylene	0	29
Elastomer Plasticizer	20	80
Rosin Ester	0	80
Terpene Resin	0	80
Filler	0	70
Calcium Carbonate	0	70
Talc	0	70

TABLE 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hard Elastomer																								
SBR	23	20	0	22	0	0	18	16	0	0	7	6	33	0	0	0	20	13	24	0	0	38	0	42
Butyl Rubber	0	0	28	0	38	38	0	0	22	26	0	19	0	31	80	32	0	0	0	21	17	0	39	0
Polyisobutylene	16	0	10	5	7	11	11	24	13	19	25	22	0	0	0	0	0	0	0	0	0	0	0	0
Rosin Ester	16	80	0	20	0	0	14	13	16	0	8	10	48	0	0	36	15	0	0	0	33	19	14	0
Terpene Resin	0	0	14	0	17	11	0	0	0	10	0	0	0	38	20	0	0	17	31	48	0	0	0	29
Filler																								
Calcium Carbonate	45	0	48	0	38	42	57	0	49	37	60	43	19	31	0	0	65	0	0	31	50	43	0	29
Talc	0	0	0	53	0	0	0	47	0	8	0	0	0	0	0	32	0	70	45	0	0	0	47	0
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Figure 9 illustrates a typical process of this present invention.

- 5 Hard elastomers, such as styrene-butadiene rubber, butyl rubber, high molecular weight polyisobutylenes and the like are first pre-blended with elastomer plasticizers such as rosin esters and terpene resins. Generally, the pre-blended material will comprise between about 20% and about 80% hard elastomer and between about 20% and about 80% elastomer plasticizer.
- 10 Optionally, fillers, colorants, etc. may be added to this pre-blend intermediate. Preferably, filler alone is added and PIB also, if PIB is required as an ingredient in the final gum base formulation.

- Pre-blending is done 91 in the presence of heat and shear to prepare the hard, and optional soft elastomers, for pulverizing. This is all done in a
- 15 suitable mixer such as a sigma blade or continuous mixer. The hard elastomer does not have to be ground prior to the pre-blending step except as necessary to feed it into the mixer, or as required by the type of mixer that is being used. A heat source providing temperatures of between about 80° C (or 176° F) and 150° C (or 302 ° F) is preferred for the pre-blending. Medium
- 20 or high shear is also typically used. This pre-blend is then removed from the mixer and particulated 94 to the appropriate size of less than or equal to about 6 millimeters, preferably to 3 millimeters, and most preferably to 0.6 millimeters or less.

- Ingredients not part of the elastomer/elastomer plasticizer pre-blend
- 25 step are held ready for use 92. These may include resins, waxes, fats, softening agents and soft elastomers. These ingredients are preferably particulated to be blended with the pulverized pre-blend. Particulated PVAc,

particulated wax and particulated gum base softeners are typical ingredients held ready for use.

Ingredients already in particulate form are prepared for use 93. These may include fillers, emulsifiers, preservatives and colorants.

5           Next, the ingredients are metered by desired weight 95 into a blending vessel 96, such as a conical mixer able to provide agitation by mechanical means. The blending vessel may be optionally cooled to aid in keeping the inventive gum base in free-flowing form.

10           After desired agitation, to suitably blend the ingredients during a designated time, the inventive particulated base is packaged to desired weight 97. Packaging may be shipping containers such as boxes, cloth or plastic sacks, bags, etc.

15           Preferred particulated gum base compositions have (by weight of the gum base) 1) between about 2% and about 43% of a pre-blend of hard elastomers and elastomer plasticizers; 2) up to about 45% elastomer plasticizer, which is preferably 0 to 45% resin ester and/or 0-24% terpene resin; 3) up to about 46% filler, which is preferable 0-39% calcium carbonate and/or 0-31% talc; 4) between about 4% and about 47% softeners; 5) up to about 36% polyvinyl acetate; 6) up to about 36% wax, which is preferably 20           0-36% microcrystalline wax and/or 0-6% paraffin wax; 7) up to about 2% antioxidant; and 8) up to about 4% colorant.

25           Table 3 shows the composition of 24 example particulated gum bases using the elastomer/elastomer plasticizer pre-blends of Table 2. These are presented to exemplify embodiments of the present invention and in no way are presented to limit the scope of the present invention.

TABLE 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Table 2, Blend 1	2																							
Table 2, Blend 2		4																						
Table 2, Blend 3			5																					
Table 2, Blend 4				7																				
Table 2, Blend 5					4																			
Table 2, Blend 6						9																		
Table 2, Blend 7							11																	
Table 2, Blend 8								18																
Table 2, Blend 9									12															
Table 2, Blend 10										18														
Table 2, Blend 11											8													
Table 2, Blend 12												6												
Table 2, Blend 13													26											
Table 2, Blend 14														39										
Table 2, Blend 15															31									
Table 2, Blend 16																23								
Table 2, Blend 17																	16							
Table 2, Blend 18																		12						
Table 2, Blend 19																			11					
Table 2, Blend 20																				18				
Table 2, Blend 21																					10			
Table 2, Blend 22																						18		
Table 2, Blend 23																							39	
Table 2, Blend 24																								43
Rosin Ester	21	13		45	13		5		11	16	12	17			31	24					26	21		18
Terpene Resin			24			12	14		23	18			21	4			11	9	7	8				
CaCO <sub>3</sub>	15		35			16	38	26	39				18	6	22			27	12		23			
Talc		25		25					7	24		13				31	25	21		9		30	22	
Softeners	24	14	25	4	6	22	17	6	13	16	47	31	29	28	8	20	25	20	34	34	24	12	10	16
Polyvinyl Acetate	25	26	10	12	38	36	28	26		12														
Microcrystalline Wax	10	16		5	26					8	33	27	4	23	6		23	36	20	28	31	25	20	
Paraffin Wax				2						6														
Antioxidant	1	1	1		1	1		1		1		2	1		2			1	1				1	
Colorant	2	1				2	1			1		4	1			2		1				1		1
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Gums were made from the pulverized base examples of Table 3.

Compositions of the inventive base were individually added to (1) sigma blade, (2) single-shaft continuous, or (3) twin-screw continuous mixers. The mixers were heated to 80° C to 150° C and had medium to high shear mixing capability. After from about 10 to 20 minutes of inventive base processing, gum ingredients such as sweeteners, flavors, etc. were added. The final gum was removed or extruded from the mixers after about 10 to 25 minutes from the time the gum ingredients were added to the base being processed in the mixer.

While not preferred, it is, of course, possible to take the particulated gum base and mix it into a molten state in a mixer and then discharge it and cool it as a conventional gum base before it is used to make chewing gum.

The advantages of the preferred embodiments of the invention are primarily in the simplification of the gum base manufacturing process. There are reduced processing, preparation and packaging costs compared to the conventional method of making gum base. Also, tailor-weighted products can be shipped to customers for direct and complete addition to conventional gum mixers. Also, the particulated gum base may be easily metered by automatic feeders.

There are also benefits and improvements compared to non-traditional chewing gum manufacturing. For example, in the process disclosed in U.S. Patent No. 5,543,160, where the gum base and chewing gum are all made in one continuous mixer, the elastomer was added in a particle size of about 2-7 millimeters. Thus, a significant portion of the overall length of the blade-and-pin mixer was required to masticate the elastomer and compound the gum base before the gum ingredients were added. Using a particulated gum base wherein the elastomer is 0.6 millimeters or less would require less mixing, and hence less equipment length, in a continuous gum making operation.

It should be appreciated that the methods and compositions of the present invention are capable of being incorporated in the form of a variety of embodiments, only a few of which have been illustrated and described below. The invention may be embodied in other forms without departing from its spirit or essential characteristics.

For example, one or more of the traditional chewing gum ingredients could be mixed with the gum base ingredients when the blend of particulated gum base ingredients is being made. That gum ingredient would then not need to be added later when the gum base was being used to make chewing gum. For example, all or part of the powdered bulk sweetener used in the gum could be blended with the particulated gum base ingredients, or a part of the particulated gum base ingredient, before being added to the gum mixer. If a sweetener were added to the particulated gum base, the material would be less likely to agglomerate, especially if the filler were not added until the chewing gum was actually being made. Also, the gum manufacturer would

need less material handling equipment if the sweetener and other powdered chewing gum ingredients were included with the particulated chewing gum base.

#### EXAMPLE 25

5           Example 25 can be carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula can be prepared:

	INGREDIENT	WEIGHT PERCENT
	Hard Elastomer –	
10	Butyl elastomer Mw > 75,000	11.85
	Soft Elastomer –	
	Polyisobutylene Mw < 75,000	3.95
	Elastomer Plasticizer –	
	Terpene Resin	19.75
15	Vinyl Polymer Elastomer –	
	Polyvinyl Acetate Mw about 14,000	27.59
	Filler –	
	Calcium Carbonate	11.85
	Emulsifier –	
20	Vegetable Oil Lecithin	3.95
	Fully Hydrogenated Fats –	
	Hydrogenated Cottonseed Oil	5.78
	Hydrogenated Soybean Oil	5.77
	Partially Hydrogenated Fats –	5.25
25	Softener –	
	Glycerol Monostearate	4.20
	Antioxidant –	
	BHT	0.06
	Total	100.00%

30           The particulate blend gum base of Example 25 can be made by blending in a v-blender 80, as depicted in FIG. 8 and described above, about 79% particulated elastomer and resin blend and about 21% a particulated wax/fat blend.

35           The elastomer and resin blend can be prepared as follows. Using a mixtruder 30 having the configuration of FIG. 3, a mixer speed of about 252 rpm, and a temperature of between about 150° F and 250° F, about 15% butyl

elastomer, 15% calcium carbonate, 5% low molecular weight polyisobutylene (Mw < 75,000) can be added to the mixer and mixed for about 15 minutes.

Thereafter, the following ingredients can be sequentially added and mixed in 5 minute intervals: about 6% terpene resin, about 19% terpene resin, about  
5 35% low molecular weight polyvinyl acetate (Mw about 14,000) and about 5% vegetable oil lecithin. The composition can have a temperature of between about 150° F and 250° F for a total mixing time of about 35 minutes.

Thereafter, the elastomer and resin blend can be removed from the mixer and extruded through an extruding screw having a temperature like that of the  
10 mixer temperature. The extrudate can be fed at about 250 to about 300 lbs/hr onto a cooling belt 41 and chilled to a temperature of about minus 19° F and 75° F thereby making the elastomer/elastomer plasticizers pre-blend hard and brittle. Next, the elastomer and resin blend can be fed into a granulator 50 and fragmented to the size of less than or equal to about 0.25 inches.

Thereafter, the fragmented elastomer/elastomer plasticizers pre-blend can be  
15 fed to a hammermill 60 and ground to a particle size less than 0.6 millimeters.

The particulated wax/fat blend can be prepared by melting and blending: 25% hydrogenated cottonseed oil, 30% hydrogenated soybean oil, 25% partially hydrogenated fat, 19.7% glycerol monostearate, and 0.3%  
20 antioxidant. The molten wax/fat blend can be spray congealed using an atomizer of the type Nordson 3800 Hot Melt Adhesive Sprayer and a configuration of FIG 7. The molten wax/fat blend can be fed through a high-pressure spray nozzle 73 using air supplied at a pressure of 80 psi, as the mixing kettle can be at a temperature of about 100° F to 350° F and the spray  
25 hose and spray head at the same temperature range. The atomized wax/fat blend can be sprayed into a cooling environment 74 having a temperature of between about minus 19° F and 75° F and a configuration of FIG. 7. Once the atomized wax/fat blend droplets leave the nozzle and contact the cooling environment, the droplets congeal and solidify as to form solid particles  
30 having an average particle size of about 0.6 millimeters.



## COMPARATIVE EXAMPLE 25A

Comparative Example 25A can be carried out according to the conventional method of manufacture. A conventional gum base with the following formula can be prepared as follows:

5           Using a sigma blade mixer, and in the presence of heat and shear, about 11.85% butyl elastomer, about 11.85% calcium carbonate, and about 3.95% low molecular polyisobutylene ( $M_w < 75,000$ ) can be added and compounded for about 30 minutes at a temperature of between about 95° C (203° F) and 120° C (or 248° F). Thereafter, about 19.75% terpene resin can  
10           be added in quarter increments every 10 minutes. After an hour of mixing, about 6.90% low molecular weight polyvinyl acetate ( $M_w$  about 14,000) can be added. After an additional 10 minutes of mixing, the remainder of the low molecular weight polyvinyl acetate ( $M_w$  about 14,000), about 20.69%, can be added and mixed for another 10 minutes. Next, about 4.20% glycerol  
15           monostearate and about 5.77% hydrogenated soybean oil can be added and mixed for 5 minutes. Then, about 0.06% antioxidant, about 5.78% hydrogenated cottonseed oil and about 5.25% partially hydrogenated fat can be added and mixed for another 5 minutes. Finally, about 3.95% vegetable oil  
20           lecithin can be added and the composition can be blended for about 10 minutes. After a total mixing time of about 1 hour 50 minutes, the conventional gum base can be removed from the mixer, passed through a basket filter using an 80-mesh sock.

As can be seen by the Example 25 and Comparative Example 25A, the particulate blend gum base of Example 25 can be formed after a mixing time  
25           of about 35 minutes whereas; Comparative Example 25A requires a mixing time of about 1 hour and 50 minutes.

## EXAMPLE 26

Example 26 can be carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the  
30           following formula can be prepared:

	INGREDIENT	WEIGHT PERCENT
	Hard Elastomer –	
	Butyl elastomer Mw > 75,000	3.95
	Styrene- Butadiene elastomer	2.37
5	Soft Elastomer –	
	Polyisobutylene Mw < 75,000	7.90
	Elastomer Plasticizer –	
	Natural Gum Rosin	15.80
	Vinyl Polymer Elastomers –	
10	Polyvinyl Acetate Mw about 14,000	7.90
	Polyvinyl Acetate Mw about 55,000	23.70
	Filler –	
	Talc	15.77
	Emulsifier –	
15	Vegetable Oil Lecithin	1.58
	Fully Hydrogenated Fats –	
	Hydrogenated Cottonseed Oil	4.72
	Hydrogenated Soybean Oil	4.73
	Partially Hydrogenated Fats –	4.20
20	Softeners –	
	Glycerol Monostearate	6.30
	Acetylated Monoglycerides	1.05
	Antioxidant –	
	BHT	0.03
25	Total	100.00%

The particulate blend gum base of Example 26 can be made by blending in a v-blender, as depicted in FIG. 8 and described above, about 80% particulated elastomer and resin blend and about 20% particulated wax/fat blend.

The elastomer and resin blend can be prepared as follows. Using a mixtruder having the configuration of FIG. 3, a sigma blade mixer speed of about 252 rpm, and a temperature of between about 150° F and 250° F, about 5% low molecular weight polyisobutylene (Mw < 75,000), about 5% butyl elastomer, about 3% styrene butadiene, about 19.86% talc and about 14% high molecular weight polyvinyl acetate (Mw about 55,000) can be added and mixed for about 20 minutes. Next, about 16% high molecular weight polyvinyl acetate (Mw about 55,000), about 5% low molecular weight polyisobutylene (Mw < 75,000), and about 8% natural gum rosin can be added and mixed for about 5 minutes. Then, about 12% natural gum rosin and about 10% low

molecular weight polyvinyl acetate (Mw about 14,000) can be added and mixed for about 5 minutes. Finally, about 2% vegetable oil lecithin can be added. After a total mixing time of about 35 minutes, the elastomer and resin blend can be removed ground to a particle size of about 0.60 millimeters or less using the method set forth in Example 25.

The particulated wax/fat blend can be prepared by melting and blending: 22% hydrogenated cottonseed oil, 23% hydrogenated soybean oil, 20% partially hydrogenated fat, 30% glycerol monostearate, 5% acetylated monoglyceride and 0.14% antioxidant to form a wax/fat blend. The molten wax/fat blend can be spray congealed using method set forth in Example 25 to form solid particles having an average particle size of about 0.6 millimeters.

#### COMPARATIVE EXAMPLE 26B

Comparative Example 26B can be carried out according to the conventional method of manufacture. A conventional gum base with the formula Example 2 can be prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 10.43% high molecular weight polyvinyl acetate (Mw about 55,000), about 2.37% styrene-butadiene elastomer, about 3.95% butyl elastomer, about 3.95% low molecular weight polyisobutylene (Mw < 75,000) and about 15.77% talc can be added and mixed for about 30 minutes. Then, about 5.21% natural gum rosin, about 13.27% high molecular weight polyvinyl acetate (Mw about 55,000) and about 3.95% low molecular weight polyisobutylene (Mw < 75,000) can be added and mixed for about 10 minutes. Next, about 70.9% low molecular weight polyvinyl acetate (Mw about 14000) can be added and mixed for about 10 minutes. Next, about 10.59% natural gum rosin can be added and mixed for about 15 minutes. Then, about 4.73% hydrogenated soybean oil and about 4.72% hydrogenated cottonseed oil can be added and mixed for 15 minutes. Thereafter, about 6.30% glycerol monostearate, about 0.03% antioxidant, about 1.05% acetylated monoglycerides and about 4.20% partially hydrogenated fat can be added

and mixed for another 15 minutes. Finally, 1.58% vegetable oil lecithin can be added and the composition can be blended for about 10 minutes.

After a total mixing time of about 1 hour 45 minutes, the conventional gum base can be removed from the mixer, passed through a basket filter using an 80-mesh sock.

As can be seen by comparing Example 26 with Comparative Example 26B, the particulate blend gum base of Example 26 can be formed after a mixing time of about 35 minutes whereas; Comparative Example 26B requires a mixing time of about 1 hour and 45 minutes.

#### EXAMPLE 27

Example 27 can be carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula can be prepared:

	INGREDIENT	WEIGHT PERCENT
15	Soft Elastomer –	
	Polyisobutylene Mw < 75,000	12.9
	Elastomer Plasticizer –	
	Natural Gum Rosin	21.5
	Vinyl Polymer Elastomer –	
20	Polyvinyl Acetate Mw about 55,000	26.7
	Filler –	
	Talc	16.3
	Fully Hydrogenated Fats –	
	Hydrogenated Cottonseed Oil	2.8
25	Softeners –	
	Glycerol Monostearate	4.9
	Glycerol Triacetate	8.6
	Wax –	
	Microcrystalline wax	2.1
30	Paraffin wax	4.2
	Total	100.0%

The particulate blend gum base of Example 27 can be made by powder blending in a v-blender as depicted in FIG. 8, about 86% particulated elastomer and resin blend and about 14% particulated wax/fat blend.

The elastomer and resin blend can be prepared as follows. The elastomer and resin blend can be prepared as follows. Using a mixtruder having the configuration of FIG. 3, a mixer speed of about 252 rpm, and a temperature of between about 150° F and 250° F, about 31% high molecular weight polyvinyl acetate (Mw about 55,000) and about 10% glycerol triacetate can be added and mixed for about 10 minutes. Next, about 25% natural gum resin and about 8% talc can be added and mixed for about 10 minutes. Finally, about 15% low molecular weight polyisobutylene Mw < 75,000 and about 17% natural gum resin can be added. Thereafter, the composition can be mixed. After a total mixing time of about 25 minutes, the elastomer and resin blend can be removed and ground to a particle size of about 0.6 millimeters using the method set forth in Example 25.

The particulated wax/fat blend can be prepared by melting and blending: about 15% microcrystalline wax, 20% by weight of hydrogenated cottonseed oil, 33.33% glycerol monostearate, 35% paraffin wax to form a wax/fat blend. The molten wax/fat blend can be spray congealed using method set forth in Example 25 to form solid particles having an average particle size of about 0.6 millimeters.

#### COMPARATIVE EXAMPLE 27C

Comparative Example 27C can be carried out according to the conventional method of manufacture. A conventional gum base having a formula of Example 27 can be prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 26.7% high molecular weight polyvinyl acetate Mw about 55,000 and about 8.6% glycerol triacetate can be added and mixed for about 15 minutes. Next, about 7.2% natural gum rosin and about 5.7% talc can be added and mixed for about 10 minutes. Then, about 8.0% natural gum rosin and about 3.6% talc can be added and mixed for about 10 minutes. Additional about 6.3% natural gum rosin and about 3.5% talc can be added and mixed for about 5 minutes. Thereafter, about 12.9% low molecular weight polyisobutylene (Mw < 75,000), and the remaining talc, about 3.5%, can be added and mixed for about 20 minutes. Then, about 4.2% paraffin wax can

be added and mixed for about 5 minutes. Next, about 2.1% microcrystalline wax can be added and mixed for another 5 minutes. Next, 2.8% hydrogenated cottonseed oil and about 2.4% glycerol monostearate can be added and mixed for about 15 minutes. Finally, about 2.5% vegetable oil lecithin can be added.

After a total mixing time of about 1 hour 30 minutes, the conventional gum base can be removed from the mixer and passed through a basket filter using an 80-mesh sock.

As can be seen by comparing Example 27 with Comparative Example 27C, the particulate blend gum base of Example 27 can be formed after a mixing time of about 25 minutes whereas; Comparative Example 27C requires a mixing time of about 1 hour and 30 minutes.

#### EXAMPLE 28

Example 28 can be carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula can be prepared:

	INGREDIENT	WEIGHT PERCENT
	Hard Elastomer –	
20	Isoprene-Isobutylene Elastomer	6.20
	Styrene-Butadiene Elastomer	2.20
	Polyisobutylene Mw > 75,000	14.40
	Elastomer Plasticizer –	
	Natural Gum Rosin	16.60
25	Vinyl Polymer Elastomer –	
	Polyvinyl Acetate Mw about 14,000	10.80
	Polyvinyl Acetate Mw about 55,000	5.00
	Filler –	
	Calcium Carbonate	19.36
30	Fully Hydrogenated Fats –	
	Hydrogenated Cottonseed Oil	6.40
	Hydrogenated Soybean Oil	4.80
	Partially Hydrogenated Fats -	2.80
	Softeners –	
35	Glycerol Monostearate	4.20
	Glycerol Triacetate	0.70
	Wax –	
	Microcrystalline wax	7.00
	Paraffin wax	2.80
40	Antioxidant –	
	BHT	0.04
	Total	100.00%

The particulate blend gum base of Example 28 can be made by powder blending in a v-blender as depicted in FIG. 8, about 72% particulated elastomer and resin blend and about 28% particulated wax/fat blend.

The elastomer and resin blend can be prepared as follows. The elastomer and resin blend can be prepared as follows. Using a mixtruder having the configuration of FIG. 3, a mixer speed of about 252 rpm, and a temperature of between about 150° F and 250° F, about 3% styrene-butadiene elastomer, about 6% isoprene-isobutylene elastomer, about 20% high molecular weight polyisobutylene (Mw > 75,000), about 2% natural gum rosin, about 7% high molecular weight polyvinyl acetate (Mw about 55,000) and about 27% calcium carbonate can be added and mixed for about 30 minutes. Next, about 12% natural gum resin, about 15% low molecular weight polyvinyl acetate (Mw about 14,000), about 1% glycerol triacetate, and the remaining natural gum rosin, about 7%, can be added, for about 10 minutes. After a total mixing time of about 45 minutes, the elastomer and resin blend can be removed and ground to a particle size of about 0.6 millimeters using the method set forth in Example 25.

The particulated wax/fat blend can be prepared by melting and blending about 24.83% microcrystalline wax, about 10% paraffin wax, about 10% partially hydrogenated fat for about 5 minutes. Next, about 15% glycerol monostearate, about 17% hydrogenated soybean oil, about 20% by hydrogenated cottonseed oil and about 0.17% antioxidant can be added and blended to form a wax/fat blend. The molten wax/fat blend can be spray congealed using method set forth in Example 25 to form solid particles having an average particle size of about 0.6 millimeters.

#### COMPARATIVE EXAMPLE 28D

Comparative Example 28D can be carried out according to the conventional method of manufacture. A conventional gum base having a formula of Example 28 can be prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 2.20% styrene-butadiene elastomer, about 4.34% isoprene-isobutylene

elastomer, about 21.6% calcium carbonate, about 1.08% natural gum rosin and about 5% high molecular weight polyvinyl acetate (Mw about 55,000) can be added and mixed for about 30 minutes. Then, about 14.40% low molecular weight polyisobutylene (Mw < 75,000) can be added and blended for about 15 minutes. Next, about 3.14% natural gum rosin can be added and mixed for about 5 minutes. Then, about 6.05% natural gum rosin can be added and mixed for about 10 minutes.

Thereafter, about 9.80% low molecular weight polyvinyl acetate (Mw about 14,000) can be added and mixed for about 10 minutes. Then, about 5.33% natural gum rosin, about 0.70% glycerol triacetate can be added. After 10 minutes of mixing, about 2.80% partially hydrogenated fat can be added and mixed for about 10 minutes.

Next, about 2.80% paraffin wax and about 3.38% microcrystalline wax can be added. After 3 minutes of mixing, an additional about 2.62% microcrystalline wax can be added and the composition can be mixed for about 7 minutes.

Thereafter, about 5.33% hydrogenated cottonseed oil, about 3.80% hydrogenated soybean oil, about 2.80% glycerol monostearate, about 2.80% partially hydrogenated vegetable oil and about 0.05% antioxidant can be added and the composition can be mixed.

After a total mixing time of about 2 hours and 10 minutes, conventional gum base can be removed from the mixer, passed through a basket filter using an 80 mesh sock.

As can be seen by comparing Example 28 with Comparative Example 28D, the particulate blend gum base of Example 28 can be formed after a mixing time of about 45 minutes whereas; Comparative Example 28D requires a mixing time of about 2 hours and 10 minutes.

Further the particulate blend gum base of Example 28 includes novel ingredients not typically found in gum base such as polyvinyl acetate (Mw about 14,000) and glycerol triacetate.



## EXAMPLE 29

Example 29 can be carried out according to the most preferred embodiment of the present invention. A particulate blend gum base with the following formula can be prepared:

5	INGREDIENT	WEIGHT PERCENT
	Soft Elastomer –	
	Polyisobutylene Mw < 75,000	10.20
	Elastomer Plasticizer –	
	Natural Gum Rosin	17.00
10	Vinyl Polymer Elastomer –	
	Polyvinyl Acetate Mw about 55,000	34.00
	Filler –	
	Talc	19.55
	Softeners –	
15	Glycerol Monostearate	4.25
	Glycerol Triacetate	8.25
	Wax –	
	Paraffin wax	6.75
	Total	100.00%

20           The particulate blend gum base of Example 29 can be made by powder blending in a v-blender depicted in FIG. 8, about 85% particulated elastomer and resin blend and about 15% particulated wax/fat blend.

25           The elastomer and resin blend can be prepared as follows. Using a mixtruder having the configuration of FIG. 3, a mixer speed of about 252 rpm, and a temperature of between about 150° F. and 250° F., about 40% high molecular weight polyvinyl acetate (Mw about 55,000), about 20% natural gum rosin, about 12% low molecular weight polyisobutylene (Mw < 75,000), about 5% glycerol triacetate and about 23% talc can be added for a total mixing time of about 10 minutes. The elastomer and resin blend can be removed and ground to a particle size of about 0.6 millimeters using the method set forth in Example 25.

30           The particulated wax/fat blend can be prepared by melting and blending about 45% paraffin wax, about 54.68% glycerol monostearate, and about 0.32% antioxidant to form a wax/fat blend. The molten wax/fat blend

can be spray congealed using method set forth in Example 25 to form solid particles having an average particle size of about 0.6 millimeters.

#### COMPARATIVE EXAMPLE 29E

Comparative Example 29E can be carried out according to the conventional method of manufacture. A conventional gum base having a formula of Example 29 can be prepared as follows:

Using a sigma blade mixer, and in the presence of heat and shear, about 34% high molecular weight polyvinyl acetate (Mw about 55,000), about 5.10% low molecular weight polyisobutylene (Mw < 75,000) and about 7.03% talc can be added and mixed for about 5 minutes. Next, 5.10% low molecular weight polyisobutylene (Mw < 75,000), about 4.25% glycerol triacetate and about 7.03% talc can be added and mixed for about 20 minutes. Then about 17.00% natural gum rosin and about 5.49% talc can be added and mixed for about 50 minutes. Then, about 6.75% paraffin wax can be added and mixed for about 20 minutes. Finally, about 8.20% glycerol monostearate and about 0.05% antioxidant can be added and the composition can be blended for about 20 minutes. After a total mixing time of about 1 hour 45 minutes, conventional gum base can be removed from the mixer, passed through a basket filter using an 80-mesh sock.

As can be seen by comparing Example 29 with Comparative Example 29E, the particulate blend gum base of Example 29 can be formed after a mixing time of about 10 minutes whereas, Comparative Example 29E requires a mixing time of about 1 hour and 45 minutes.

Further the particulate blend gum base of Example 29 does not include a hard elastomer but does include novel ingredients not typically found in gum base such as glycerol triacetate.

#### METHODS OF PREVENTING AGGLOMERATION

One aspect of the present invention is drawn to a method for preventing agglomeration of one or more powder gum base ingredients by blending a plurality of particulate blend gum base ingredients with an anti-caking agent.

In general, a plurality of particulated gum base ingredients are added to the v-blender (80) and blended for about 3 to about 60 minutes, preferably for about 5 to about 15 minutes, and most preferably for about 10 minutes or less to form a particulate blend of gum base ingredients. An anti-caking agent is added to the particulate blend of gum base ingredients at a level sufficient to prevent the particulate blend gum base from agglomerating when left unagitated at a temperature of at least about 58° F for a period of at least about 48 hours. Preferably, the particulate blend of gum base ingredients is maintained in a low moisture environment. As used herein, the term "low moisture environment" refers to an environment having a low relative humidity and, more specifically refers to an environment having a relative humidity of 35% or less.

Preferably, the anti-caking agent is selected from the group consisting of fillers, bulk sweeteners, glycerol monostearate, elastomer plasticizers, fused silica and mixtures thereof.

When the anti-caking agent is glycerol monostearate, it is present in the amount of between about 5% and 20% by weight of the particulate blend gum base.

Alternatively, when the anti-caking agent is filler, it is present in the amount of between about 0 to about 70% by weight of the particulate blend gum base. More preferably, the filler is selected from the group consisting of calcium carbonate, magnesium carbonate, ground limestone, silicates, zirconium silicate, clay, alumina, talc, titanium oxide, mono- di and tridcalcium phosphate, cellulose polymers and mixtures thereof.

Elastomer plasticizers suitable for use as anti-caking agents include natural rosin esters, glycerol ester of partially hydrogenated rosin, glycerol ester of polymerized rosin, glycerol ester of partially dimerized rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, pentaerythritol esters of partially hydrogenated rosin, partially hydrogenated methyl esters of rosin, pentaerythritol ester of rosin, synthetic elastomer plasticizers, terpene resins derived from alpha-pinene, beta-pinene and d-limonene and mixtures thereof

and can be added to the blend at a level of between about 0.5% to about 20%.

Sugar sweeteners suitable for use as anti-caking agents include sucrose, dextrose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids and combinations thereof and can be added to the blend at a level of up to about 80%.

Sugarless sweeteners suitable for use as anti-caking agents include sorbitol, mannitol, xylitol, hydrogenated starch hydrolysates, maltitol and combinations thereof and can be added to the blend at a level of up to about 80%.

When the anti-caking agent is a fused silica it can be added to the blend at a level of between about 0.5% and about 2%.

High intensity sweeteners suitable for use as anti-caking agents include sucralose, aspartame, salts of acesulfame, alitame, saccharin and its salts, cyclamic acid and its salts, gycyrrhizin, dyhydrochalcones, thaumatin, monellin and combinations thereof.

In another aspect, the present invention includes aspects drawn to a method for preventing agglomeration of one or more powder gum base ingredients by agitating a particulate blend of gum base ingredients.

In general, a plurality of particulated gum base ingredients are added to the v-blender (80) and blended for about 3 to about 60 minutes, preferably for about 5 to about 15 minutes, and most preferably for about 10 minutes or less to form a particulate blend of gum base ingredients. The particulate blend of gum base ingredients are agitated until just prior to the addition of the particulate blend of gum base ingredients to a gum mixer.

#### METHOD OF MAKING GUM BASES WITH A HIGH DEGREE OF CONSISTENCY FROM ONE BATCH TO THE NEXT

In another aspect, the present invention is drawn to a method of manufacturing a gum base so as to have a high degree of consistency from one batch. The use of particulated gum base ingredients to form a particulated blend of gum base ingredients without forming a molten gum

base ensures a more accurate delivery of the gum base ingredients to the blender. In addition, blending the gum base ingredients without forming a molten gum base greatly simplifies the cleaning of the process equipment. Preferably, cleaning the process equipment merely entails blowing air through, or tapping on the sides of, the process equipment.

In general, gum base ingredients in particulate form are blended without forming a molten gum base to form a first batch of powder blend gum base. The first batch of particulate blend gum base is emptied from the mixer and tested for percent ash content, antioxidant content and softening point. A second batch of particulate blend gum base is prepared by repeating the process and blending subsequent gum base ingredients in particulate form without forming a molten gum base to form a second batch of particulate blend gum base. The second batch of particulate blend gum base is emptied from the mixer and tested for percent ash content, antioxidant content and softening point. The variation in percent ash content, antioxidant content and softening point between the first and the subsequent batch is about 5% or less. More preferably, the variation is about 1% or less.

#### METHODS OF MAKING GUM BASES WITH MINIMAL CONTAMINATION

In another aspect, the present invention is drawn to a method of manufacturing two or more gum bases each having a different composition using the same equipment and minimizing the amount of first composition carried over into the second composition between the manufacture of the first gum base and the second gum base.

In general, a plurality of first gum base ingredients in particulate form are added to a mixer, blended to form a first particulate particulate blend of first gum base ingredients and emptied out of the mixer. Preferably, the mixer is a "V" shaped powder blender as depicted in FIG. 8.

The use of particulated gum base ingredients to form a particulate blend of gum base ingredients minimizes the amount of residual gum base left behind in the process equipment. The amount of first gum base ingredients

left behind in the mixer is less than about 1% of the volume of the mixer. Subsequently, a plurality of second gum base ingredients is added to the mixer and blended to form a particulate blend of second gum base ingredients.

5                                    REMOTELY CONTROLLED METHODS OF MAKING  
   A PARTICULATE BLEND GUM BASE

   In another aspect, the present invention is drawn to a remotely controlled method for making a particulate blend gum base from a plurality of gum base ingredients in a particulate form comprising the steps of: providing  
10                                    a plurality of storage compartments each storing at least one of said plurality of gum base ingredients in a particulate form; providing automated controls to allow remote control dispensing of said at least one of said plurality of gum base ingredients in a particulate form from each of said storage  
   compartments; selecting a gum base to be made; remotely activating said  
15                                    controls to dispense a desired amount of each of said at least one of said plurality of gum base ingredients in a particulate form from said plurality of storage compartments; and blending the desired amounts of the plurality of gum base ingredients in particulate form to form a particulate blend gum base.

   Preferably, the ingredients are dispensed onto a conveyor by which  
20                                    they are conveyed to a powder blender.

   Preferably, all of the ingredients for one batch of gum base are dispensed into one collecting container, which is then used to transport the ingredients to a powder blender.

   Preferably, a computer has a plurality of gum base recipes stored  
25                                    therein and signals the controls to said plurality of dispense gum base ingredients in particulate form based on a selected one of said recipes stored in the computer.

   Preferably, at least some of the storage compartments are equipped with agitators to maintain the at least one gum base ingredient in particulate  
30                                    form stored therein in a free-flowing state.

Preferably, at least one of the storage compartments houses a pulverized hard elastomer pre-blended with an elastomer plasticizer.

Optionally, the storage compartments can be storage containers.

5 Preferably, the final packaged particulated product is rotated or mechanically blended to provide a consistent mix of each individual particulated ingredient or blends of particulated ingredients within the package.

#### METHODS OF MAKING A BATCH OF GUM

10 One aspect of the present invention is drawn to a method of making a batch of gum. In general, one or more containers each of which contains pre-weighed amounts of a plurality of gum base ingredients in particulate form are emptied into a gum mixer. Additional gum ingredients are added to the gum mixer to prepare for making a batch of gum. The gum base ingredients and additional gum ingredients are mixed to form a batch of gum.

15 Preferably, the containers are bags. More preferably, the gum base ingredients in the containers are homogeneously blended together before being placed in the containers. Although it is not preferred, the particulate blend gum base ingredients in the containers can be at least partially agglomerated. Most preferably, the particulate gum base ingredients in the containers are in the form of a free-flowing powder. Preferably, each of the  
20 containers of particulated gum base ingredients includes an anti-caking agent.

Preferably, the gum base ingredients are mixed together in the mixer prior to the addition of any of the additional gum ingredients to the mixer. Alternatively, but less preferred, the additional gum ingredients are added to  
25 the mixer prior to when the one or more containers of gum base ingredients are emptied into the mixer.

#### METHODS OF MAKING A GUM HAVING A TEMPERATURE SENSITIVE INGREDIENT

30 One aspect of the present invention is drawn to a method of making a gum composition comprising a temperature sensitive ingredient. The low temperature and shorter mixing times used in the method of the present

invention facilitate the use of temperature sensitive ingredients in the manufacture of gum.

In general, a particulate blend gum base and other gum ingredients, including a temperature sensitive ingredient, are added to a gum mixer and mixed to form a gum composition. The temperature sensitive ingredient is mixed into the other ingredients earlier in the mixing process than when the temperature sensitive ingredient is conventionally mixed into the gum composition made using a molten gum base.

Temperature sensitive ingredient suitable for use include active agents, emulsifiers such as lecithin, antioxidants, flavor agents, high-intensity sweeteners, and combinations thereof.

Preferably, the particulated gum base ingredients are added to a gum mixer having an initial kettle temperature of between about 20° C ( or 68° F) to about 40° C (or 104° F.).

Preferably, the powder blend gum base and the other gum ingredients, including the temperature sensitive ingredient are mixed for a period of time to form a gum composition. More preferably, the period of time is shorter than the period of time required to mix a conventional gum composition using a melted gum base.

Alternatively, the temperature sensitive ingredient can be added to the mixer prior to the addition of the powder blend gum base.

Alternatively, the temperature sensitive ingredient can be mixed into the other ingredients with the initial addition of gum ingredients in the mixing process.

#### METHODS OF MAKING A GUM USING REDUCED TEMPERATURES

Another aspect of the present invention is drawn to a method of making a gum composition using reduced temperatures. In general, gum base ingredients in particulate form are added to a gum mixer having an initial kettle temperature of between about 20° C (or 68° F) to about 40° C (or 104° F) and adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition.



#### METHODS OF MAKING A GUM USING REDUCED MIXING TIME

Another aspect of the present invention is drawn to a method of making a gum composition using a particulate blend gum base and mixing the gum for less time than would be used to make the same gum composition using a gum base having the same composition as the particulate blend gum base but in a melted state.

5

#### METHODS OF MAKING A GUM AND WRAPPING GUM PRODUCTS WITHOUT CONDITIONING

Another aspect of the present invention is drawn to a method of making a gum composition and wrapping gum products made therefrom without the need to condition the gum composition prior to wrapping.

10

In general, a particulate blend gum base is used to make a gum composition. The gum composition is formed into stick and the gum products are wrapped without conditioning the gum.

15

Preferably, the gum products are wrapped within less than an hour after being formed from the composition.

## Claims

1. A method of making a particulate blend gum base comprising the steps of:

5 a) providing at least one first gum base ingredient having a softening point of less than about 130° F;

b) providing a second gum base ingredient;

c) combining said at least one first and second gum base ingredients to form a combined ingredient having a particulated, free-flowing form;

10 d) blending the combined ingredient at a temperature in the range of about 40° F to about 90° F with at least a third gum base ingredient to form the particulate blend gum base, said particulate blend base comprising at least an elastomer, a softener, an antitack ingredient, and a filler.

15 2. The method of claim 1 wherein the first and second ingredients are initially mixed to form a combined ingredient having a softening point intermediate of the softening points of the first and second ingredients.

3. The method of claim 1 wherein the first ingredient is an elastomer plasticizer and the second ingredient is a hard elastomer.

20 4. The method of claim 3 wherein the elastomer plasticizer and hard elastomer are blended and then pulverized.

5. The method of claim 1 wherein the second ingredient is used to encapsulate the first ingredient.

25 6. The method of claim 1 wherein the first ingredient is selected from the group consisting of elastomer plasticizers, softeners, emulsifiers, fats, waxes, flavor oils, and combinations thereof and the second ingredient is selected from the group consisting of hard elastomers, soft elastomers, vinyl polymer elastomers, fillers, antioxidants, and combinations thereof.

7. The method of claim 1 where the first and second ingredients are spray congealed to form the combined ingredient.

8. The method of claim 7 wherein the first ingredient is selected from the group consisting of fats, waxes, emulsifiers, softeners, flavor oils, and combinations thereof and the second ingredient is selected from the group consisting of antioxidants, particulate flavoring agents, nutraceuticals, pharmaceuticals and combinations thereof.

9. The method of claim 1 wherein the antitack ingredient is selected from the group consisting of fats and waxes.

10. A method of making a gum product comprising tabletizing the particulate gum base of claim 1.

11. The method of claim 1 wherein the combined ingredient is formed by into a particulated, free-flowing form by being solidified and then size-reduced.

12. The method of claim 1 wherein the combined ingredient is formed into particulated, free flowing form by being subdivided in a liquid state and then solidified.

13. The method of claim 1 wherein the blending is carried out at a temperature in the range of 50-75° F.

14. The method of Claim 6 wherein the liquid gum base ingredient is selected from the group consisting of vegetable oil lecithin, glycerol triacetate, acetalated monoglycerides, medium chain monoglycerides and vegetable oils.

15. A method of making a particulate blend gum base that uses soft elastomers comprising the steps of:

a) melting a soft elastomer and an elastomer plasticizer together to form a homogeneous molten mixture;

b) cooling and processing the homogeneous molten mixture to form a solid mixture in a particulated state; and

c) blending the particulated soft elastomer/elastomer plasticizer with other gum base ingredients to form said gum base.

5           16. The method of claim 15 wherein the soft elastomer is selected from the group consisting of polybutenes having an average molecular weight from about 5,000 to less than about 30,000, polyisobutylenes having an average molecular weight from about 30,000 to less than about 75,000 and mixtures thereof.

10           17. The method of claim 15 wherein the molten mixture is cooled to a solid and pulverized to form the particulated state.

18. The method of claim 15 wherein the molten mixture is atomized and then cooled to a solid form.

15           19. The method of claim 18 wherein said molten mixture has a viscosity of less than 80,000 centipoises at about 250° F.

20           20. The method of claim 15 wherein the elastomer plasticizer is selected from the group consisting of natural rosin esters, glycerol ester of partially hydrogenated rosin, glycerol ester of polymerized rosin, glycerol ester of partially dimerized rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, pentaerythritol esters of partially hydrogenated rosin, partially hydrogenated methyl esters of rosin, pentaerythritol ester of rosin, synthetic elastomer plasticizers, terpene resins derived from alpha-pinene, beta-pinene and d-limonene and mixtures thereof.

25           21. A method of making a particulate blend gum base that uses at least one soft elastomer comprising the steps of:

a) melting at least one soft elastomer and at least one polyvinyl acetate together to form a homogeneous molten mixture;

b) cooling and processing the homogeneous molten mixture to form a solid mixture in a particulated state; and

c) blending the particulated soft elastomer/polyvinyl acetate with other gum base ingredients to form said particulate blend gum base.

5           22. The method of claim 21 wherein the soft elastomer is selected from the group consisting of polybutenes having an average molecular weight from about 5,000 to less than about 30,000, polyisobutylenes having an average molecular weight from about 30,000 to less than about 75,000 and mixtures thereof.

10           23. The method of claim 21 wherein the molten mixture is cooled to a solid and pulverized to form the particulated state.

          24. The method of claim 21 wherein the molten mixture is atomized and then cooled to a solid form.

15           25. The method of claim 24 wherein the molten mixture has a viscosity of less than about 80,000 centipoises at about 250° F.

          26. A method of making a particulate blend gum base comprising:  
a) providing a fat and a wax;  
b) mixing the fat and the wax together in a molten state;  
c) cooling the fat and wax blend and forming a particulate  
20 material; and  
d) blending the fat and wax particulate material with other particulated gum base ingredients to form the particulate blend gum base.

          27. The method of claim 26 wherein the particulate fat and wax material has a median particle size of less than about 1 millimeters.

25           28. The method of claim 26 wherein the particulate fat and wax material has a median particle size of less than about 0.6 millimeters.

29. The method of claim 26 wherein the particulate fat and wax material has a median particle size of less than about 425 microns.

30. The method of claim 26 wherein the fat is selected from the group consisting of fully saturated oils that contain, as one or more of their constituent groups, fatty acids of carbon chain length of from 6 to 18 and triglycerides having a total summated saturated caprioic, caprylic, capric, lauric, myristic and palmitic fatty acid content of from about 8 to about 60 percent by weight of the fatty acids, determined from the fatty acid methyl ester distribution by gas chromatography.

31. The method of claim 26 wherein the wax is selected from the group consisting of petroleum waxes containing predominantly iso-alkanes having a carbon chain length greater than about 30, and synthetic waxes.

32. A method of combining a fat and wax to form an ingredient that can be used to make a particulate blend gum base comprising the steps of:

a) providing a fat selected from the group consisting of fully saturated oils that contain, as one or more of their constituent groups, fatty acids of carbon chain length of from 6 to 18 and triglycerides having a total summated saturated caprioic, caprylic, capric, lauric, myristic and palmitic fatty acid content of from about 8 to about 60 percent by weight of the fatty acids, determined from the fatty acid methyl ester distribution by gas chromatography;

b) providing a wax selected from the group consisting of petroleum waxes containing predominantly iso-alkanes having a carbon chain lengths greater than about 30, and synthetic waxes.;

c) melting the fat and wax together to form a melted fat and wax blend;

d) cooling the melted fat and wax blend to form a particulated gum base ingredient.

33. The method of claim 32 wherein the particulate material is formed after cooling the combination to solidify it.

34. The method of claim 32 wherein the melted fat and wax are sprayed as a blended molten mixture and cooled to form spray congealed particles.

35. The method of claim 34 wherein the particles have a mean particle size of less than about 1 millimeters.

36. The method of claim 34 wherein the particles have a mean particle size of less than about 0.6 millimeters.

37. The method of claim 34 wherein the particles have a mean particle size of less than about 425 microns.

38. The method of claim 32 further comprising the step of adding an anti-caking agent to the combined fat and wax ingredient to prevent agglomeration.

39. The method of claim 38 wherein the anti-caking agent is selected from the group consisting of fillers, bulk sweeteners, glycerol monostearate and elastomer plasticizers.

40. The method of claim 38 wherein the anti-caking agent is added at a level of between about 0.5% and about 80% of the total weight of the ingredient.

41. The method of claim 38 wherein the anti-caking agent is added at a level of between about 0.5% and about 10% of the total weight of the ingredient.

42. A method of preparing a particulate blend gum base comprising the steps of:

a) melting a gum base ingredient;

b) spraying the melted gum base ingredient through an atomizing nozzle and cooling the ingredient to form a solid, particulated gum base ingredient; and

c) blending the particulated gum base ingredient with other particulated gum base ingredients to form the particulate blend gum base.

43. The method of claim 42 wherein at least one of the other particulated gum base ingredients is pulverized.

44. The method of claim 42 wherein the gum base ingredient that is melted is selected from the group consisting of elastomer plasticizers, microcrystalline and parafin waxes, fully hydrogenated fats and emulsifiers.

45. The method of claim 42 wherein a second ingredient is mixed into the melted gum base ingredient prior to spraying the melted gum base ingredient through the atomizing nozzle.

46. The method of claim 45 wherein the second ingredient is a gum base ingredient.

47. The method of claim 45 wherein the second ingredient is a chewing gum ingredient.

48. The method of claim 45 wherein the second ingredient is an active agent.

49. A method of making a particulate blend gum base comprising the steps of:

a) blending two or more gum base ingredients together in a liquid form to form a combined ingredient; said combined ingredient having a viscosity of less than 80,000 centipoises at about 250° F;

b) solidifying the combined ingredient in a particulated form; and

c) blending the particulated combined ingredient with at least one other gum base ingredient to form the particulated blend gum base.



50. The method of claim 49 wherein the combined ingredient is solidified in a particulated form by being atomized in a liquid form and then solidified.

5 51. A method of making a particulate blend gum base comprising the steps of:

a) providing a first gum base ingredient having a softening point greater than 130° F;

b) providing a second gum base ingredient;

10 c) melting and blending said at least first gum base ingredient with said second gum base ingredient to form a combined ingredient having a liquid form;

d) spraying said combined ingredient to form an atomized spray;

15 e) hardening said atomized spray to form a combined ingredient that is then used to make said particulated blend gum base.

52. The method of claim 51 wherein the second ingredient has a softening point of less than 130° F.

53. The method of claim 51 wherein the second ingredient is a liquid at 75° F.

20 54. The method of claim 51 wherein the second ingredient comprises solid particles with a particle size of 0.6 millimeters or less.

55. The method of claim 51 wherein the first gum base ingredient is selected from the group consisting of elastomer plasticizers, hydrogenated fats, waxes and emulsifiers, each having a softening point of greater than  
25 130° F.

56. The method of claim 54 wherein said second gum base ingredient is selected from the group consisting of nutraceuticals,

pharmaceuticals, powdered flavoring agents, high-intensity sweeteners and deoiled lecithins.

57. A method of making a particulate gum base comprising the steps of:

- 5                   a)     providing a first gum base ingredient that has viscosity greater than about 80,000 centipoises at 250° F;
- b)     providing a second gum base ingredient;
- c)     blending and melting said at least said first and second gum base ingredients to form a combined ingredient having a viscosity less than about 80,000 centipoises at 250° F;
- 10                  d)     spraying said combined ingredient to form an atomized spray;
- e)     hardening said atomized spray to form an ingredient that is then used to make said particulate blend gum base.

15                  58.     The method of claim 57 wherein said first gum base ingredient is a polyvinyl acetate having a molecular weight greater than 5000.

59.     The method of claim 57 wherein the second ingredient has a softening point of less than 130° F.

20                  60.     The method of claim 57 wherein the second ingredient is a liquid at 75°F.

61.     The method of claim 57 wherein the second ingredient comprises solid particles with a particle size of 0.6 millimeters or less.

25                  62.     The method of claim 57 wherein the second gum base ingredient is selected from the group consisting of elastomer plasticizers, hydrogenated fats, waxes and emulsifiers.

63.     The method of claim 61 wherein said second gum base ingredient is selected from the group consisting of neutraceuticals,

pharmaceuticals, powdered flavoring agents, high-intensity sweeteners and deoiled lecithins.

64. The method of claim 57 wherein the combined ingredient is sprayed into a refrigerated atmosphere.

5           65. A method of preventing agglomeration of one or more particulate gum base ingredients comprising the steps of:

a) providing a plurality of particulate gum base ingredients;

b) blending the plurality of particulate gum base ingredients;

and

10           c) adding an anti-caking agent to the blend of particulate gum base ingredients at a level sufficient to prevent the blend of particulate gum base from agglomerating when left unagitated at a temperature of at least 58° F for a period of at least about 48 hours.

15           66. The method of claim 65 wherein the anti-caking agent is selected from the group consisting of fillers, bulk sweeteners, glycerol monostearate, elastomer plasticizers, fumed silica and mixtures thereof.

67. The method of claim 65 wherein the anti-caking agent is glycerol monostearate, and is added to the blend at a level of between about 5% and about 20% of the total weight.

20           68. The method of claim 65 wherein the anti-caking agent is a filler and the filler is added to the blend at a level of up to about 70% of the total weight.

25           69. The method of claim 65 wherein the anti-caking agent is a filler selected from the group consisting of calcium carbonate, magnesium carbonate, ground limestone, silicates, zirconium silicate, clay, alumina, talc, titanium oxide, mono- di- and tricalcium phosphate, cellulose polymers and mixtures thereof.

5           70.    The method of claim 65 wherein the anti-caking agent comprises a sugar sweetener selected from the group consisting of sucrose, dextrose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids and combinations thereof and is added to the blend at a level of up to about 80% of the total weight.

10           71.    The method of claim 65, wherein the anti-caking agent comprises a sugarless sweetener selected from the group consisting of sorbitol, mannitol, xylitol, hydrogenated starch hydrolysates, maltitol and combinations thereof and is added to the blend at a level of up to about 80% of the total weight.

          72.    The method of claim 65 further comprising the step of maintaining the blend of particulate gum base ingredients in an environment with a relative humidity of 35% or less.

15           73.    The method of claim 65, wherein the anti-caking agent comprises a fumed silica and is added to the blend at a level of between about 0.5% and about 2% of the total weight.

20           74.    The method of claim 65 wherein the anti-caking agent is an elastomer plasticizer selected from the group consisting of natural rosin esters, glycerol ester of partially hydrogenated rosin, glycerol ester of polymerized rosin, glycerol ester of partially dimerized rosin, glycerol ester of rosin, glycerol ester of tall oil rosin, pentaerythritol esters of partially hydrogenated rosin, partially hydrogenated methyl esters of rosin, pentaerythritol ester of rosin, synthetic elastomer plasticizers, terpene resins derived from alpha-pinene, beta-pinene and d-limonene and mixtures thereof  
25           and is added to the blend at a level of between about 0.5% and about 20% of the total weight.

          75.    A method of preventing agglomeration of one or more particulate gum base ingredients comprising the steps of:

- a)    providing a plurality of particulate gum base ingredients;

b) blending the plurality of particulate gum base ingredients;  
and

c) agitating the blend of particulate gum base ingredients  
until just prior to the addition of the blend of particulate gum base ingredients  
to a gum mixer.

76. A method of manufacturing gum base so as to have a high  
degree of consistency from one batch to the next comprising the steps of:

- a) providing gum base ingredients in a particulate form;  
b) particulate blending the gum base ingredients together  
without forming a molten gum base to form a first batch of particulate blend  
gum base; said first batch of particulate blend gum base having a first ash  
content, a first antioxidant content and a first softening point;  
c) repeating steps a) and b) to form a second batch of  
particulate blend gum base; said second batch of particulate blend gum base  
having a second ash content, a second antioxidant content and a second  
softening point;  
d) wherein said first ash content and said second ash  
content have a variation of about 5% or less.

77. The method of claim 76 wherein said first antioxidant content  
and said second antioxidant content have a variation of about 5% or less.

78. The method of claim 76 wherein said first softening point and  
said second softening point have a variation of about 5% or less.

79. A method of manufacturing a first gum base having a first  
composition and subsequently manufacturing a second gum base having a  
second composition, using the same equipment and minimizing the amount of  
the first composition carried over into the second composition between the  
manufacture of the first gum base and the second gum base comprising the  
steps of:

- a) providing a plurality of first gum base ingredients in  
particulate form;

b) providing a plurality of second gum base ingredients in particulate form;

c) adding the plurality of first gum base ingredients to a mixer, particulate blending the plurality of first gum base ingredients to form a particulate blend of first gum base ingredients and emptying the particulate blend of first gum base ingredients out of the mixer; said mixer retaining a residual amount of first gum base ingredients of less than about 1% of the volume of the mixer; and

d) adding the plurality of second gum base ingredients to the mixer and powder blending the ingredients to form the second gum base.

80. The method of claim 79 wherein the mixer is a "V" shaped powder blender.

81. A method of making a particulate gum base from a plurality of gum base ingredients in a particulate form comprising the steps of:

a) providing a plurality of storage compartments each storing at least one of said plurality of gum base ingredients in a particulate form;

b) providing automated controls to allow remote control dispensing of said at least one of said plurality of gum base ingredients in a particulate form from each of said storage compartments;

c) selecting a gum base to be made;

d) remotely activating said controls to dispense a desired amount of each of said at least one of said plurality of gum base ingredients in a particulate form from said plurality of storage compartments; and

e) blending the desired amounts of the plurality of gum base ingredients in particulate form to form a particulate blend gum base.

82. The method of claim 81 wherein the ingredients are dispensed onto a conveyor by which they are conveyed to a powder blender.

83. The method of claim 81 wherein all of the ingredients for one batch of gum base are dispensed into one collecting container which is then used to transport the ingredients to a powder blender.

5 84. The method of claim 81 wherein a computer has a plurality of gum base recipes stored therein and signals the controls to said plurality of dispense gum base ingredients in particulate form based on a selected one of said recipes stored in the computer.

10 85. The method of claim 81 wherein at least some of the storage compartments are equipped with agitators to maintain the at least one gum base ingredient in particulate form stored therein in a free-flowing state.

86. The method of claim 81 wherein at least one of the storage compartments houses a pulverized hard elastomer pre-blended with an elastomer plasticizer.

15 87. The method of claim 81 wherein said storage compartment comprises a storage container.

88. A method of making a batch of gum comprising the steps of:

20 a) providing one or more containers that contains pre-weighed amounts of a plurality of gum base ingredients sufficient to form one batch of gum, the plurality of gum base ingredients being in a particulate form;

b) emptying the entire contents of said one or more containers into a gum mixer;

c) adding additional gum ingredients to the gum mixer sufficient to form one batch of gum; and

25 d) mixing the gum base ingredients and additional gum ingredients to form a batch of gum.

89. The method of claim 88 wherein each of the containers of gum base ingredients further comprises an anti-caking agent.

90. The method of claim 89 wherein said batch of gum has said anti-caking agent dispersed throughout.

91. The method of claim 88 wherein the one or more containers each comprises a bag.

5 92. The method of claim 88 wherein the gum base ingredients in the one or more containers are homogeneously blended together before being placed in the containers.

10 93. The method of claim 88 wherein the gum base ingredients are mixed together in the mixer prior to the addition of any of the additional gum ingredients to the mixer.

94. The method of claim 88 wherein the additional gum ingredients are added to the mixer prior to when the one or more containers of gum base ingredients are emptied into the mixer.

15 95. The method of claim 88 wherein the particulate gum base ingredients in the one or more containers are in the form of a free-flowing powder.

96. The method of claim 88 wherein the gum base ingredients in the one or more containers are at least partially agglomerated .

20 97. The method of claim 88 wherein all of the base for one batch of gum is contained in one container.

98. A method of manufacturing gum comprising the steps of:  
a) providing a plurality of particulated gum base ingredients;  
b) providing additional gum ingredients;  
c) adding a combination of the particulated gum base  
25 ingredients to a gum mixer as a particulate blend; the gum mixer having an initial kettle temperate of between about 20° C and about 40° C;  
d) adding the additional gum ingredients to the mixer;



e) mixing the combination of the particulated gum base ingredients and additional gum ingredients in the gum mixer to form a gum composition.

5 99. The method of claim 98 wherein the gum mixer is a continuous mixer.

100. The method of claim 98 wherein the gum composition is manufactured in batches.

10 101. The method of claim 98 wherein the particulated blend of the plurality of particulated gum base ingredients is prepared at the same facility as where the blend is used.

102. The method of claim 98 wherein the gum mixer is a low efficiency mixer.

15 103. The method of claim 98 wherein the combination of the particulated gum base ingredients and the gum ingredients are added at the same time to the mixer.

104. The method of claim 98 wherein the combination of the particulated gum base ingredients includes a pre-blend of elastomer, elastomer plasticizer and filler.

20 105. The method of claim 98 wherein the combination of the particulated, gum base ingredients includes a spray congealed blend of gum base ingredients comprising a fat and a wax.

106. The method of claim 105 wherein said spray congealed blend of gum base ingredients further comprises an emulsifier.

25 107. The method of claim 105 wherein said spray congealed blend of gum base ingredients further comprises at least one flavoring agent.

108. The method of claim 98 wherein the combination of the particulated gum base ingredients includes a spray congealed blend of gum base ingredients comprising at least one gum base ingredient that is a liquid at 75° F.

5           109. The method of claim 108 wherein said liquid gum base ingredient is selected from the group consisting of vegetable oil lecithin, glycerol triacetate, acetalated monoglycerides, medium chain monoglycerides and vegetable oils.

10           110. The method of claim 98 wherein the combination of the particulated gum base ingredients includes a spray congealed blend of gum base ingredients comprising at least one liquid gum base ingredient; said spray congealed blend of gum base ingredients having a viscosity of less than 80,000 centipoises at 250° F.

15           111. The method of claim 110 wherein said liquid gum base ingredient is molten.

          112. A method of claim 98 wherein the mixing of the plurality of particulated gum base ingredients and additional gum ingredients in the gum mixer forms the gum composition within 10 minutes.

20           113. The method of claim 112 wherein the particulate blend of gum base ingredients includes at least one flavoring agent.

          114. The method of claim 112 wherein the additional gum ingredients in the gum mixer includes at least one flavoring agent.

          115. The method of claim 98 wherein the particulated gum base ingredients have a mean particle size of about 30 microns.

25           116. A method of making a gum composition using reduced temperature comprising the steps of:

          a) providing gum base ingredients in a particulate form;

b) adding the particulate gum base ingredients to a gum mixer;

c) adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition, the contents of the mixer not exceeding a temperature of 120° F throughout the mixing process.

117. A method of making chewing gum comprising the steps of:

a) providing at least one first gum base ingredient having a softening point of less than about 130° F;

b) providing a second ingredient that is used to make chewing gum;

c) combining at least said first gum base ingredient and said second gum ingredient to form a combined ingredient having a particulated form; and

d) combining the combined ingredient with at least a third gum ingredient to form a chewing gum composition.

118. The method of claim 117 wherein the combined ingredient has a softening point intermediate of the softening points of the first and second ingredients.

119. The method of claim 117 wherein the second ingredient is used to encapsulate the first ingredient.

120. The method of claim 117 wherein the first and second ingredients are spray congealed to form the combined ingredient.

121. The method of claim 117 wherein the second gum ingredient is selected from the group consisting of bulk sweeteners, high-intensity sweeteners, flavoring agents and combinations thereof.

122. A method of making a chewing gum composition that contains a temperature sensitive ingredient comprising:

a) providing a particulate blend gum base;

b) adding the particulate blend gum base to a gum mixer;  
c) adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients to form a chewing gum composition, the temperature sensitive ingredient being mixed into the other ingredients earlier in the mixing process than when the temperature sensitive ingredient is conventionally mixed into the chewing gum composition made using a melted gum base.

123. The method of claim 122 wherein the temperature sensitive ingredient is selected from the group consisting of active agents, antioxidants, flavors, high-intensity sweeteners, and combinations thereof.

124. The method of claim 122 wherein the temperature sensitive ingredient is added to the mixer prior to the addition of the powder blend gum base.

125. An improved method of making a gum composition wherein the improvement comprises using a gum base in a particulate blend form and mixing the gum for less time than would be used to make the same gum composition using a gum base having the same composition as the particulate blend but in a melted state.

126. A method of making a gum composition that contains a temperature sensitive ingredient comprising:

- a) providing a particulate blend gum base;
- b) adding the particulate blend gum base to a gum mixer;
- c) adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and
- d) mixing the ingredients, including said temperature sensitive ingredient, for a period of time to form a gum composition; said period of time being shorter than the period of time required to mix a conventional gum composition using a melted gum base.

127. A method of making a gum composition that contains a temperature sensitive ingredient comprising:

5                   a) providing a particulate blend gum base;  
                  b) adding the particulate blend gum base to a gum mixer;  
                  c) adding other gum ingredients, including said temperature sensitive ingredient, to the gum mixer and mixing the ingredients including said temperature sensitive ingredient, to form a gum composition; the temperature sensitive ingredient being mixed into the other ingredients with the initial addition of gum ingredients in the mixing process.

10               128. The method of claim 127 further comprising the step of tabletizing said gum composition to form a tabletized gum.

15               129. The method of claim 127 wherein the temperature sensitive ingredient is selected from the group consisting of active agents, flavor oils, powdered flavors, high-intensity sweeteners, pharmaceuticals and nutraceuticals.

130. A method of making a gum composition using reduced temperature comprising the steps of:

20                   a) providing gum base ingredients in a particulate blend form;  
                  b) adding the particulate blend gum base ingredients to a gum mixer having an initial kettle temperature of between about 20° C and about 40° C;  
                  c) adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition.

25               131. A method of making a gum composition and wrapping gum products made therefrom without the need to condition the gum composition prior to wrapping, comprising the steps of:

                  a) using a particulate blend gum base to make a gum composition;

b) forming the gum composition into gum sticks; and  
c) wrapping the products without conditioning the gum sticks.

5 132. The method of claim 131 wherein the products are wrapped within less than an hour after being formed from the composition.

133. The method of claim 131 wherein the particulate blend gum base includes at least one ingredient comprising a pre-blend of an elastomer and elastomer plasticizer, but wherein the pre-blend has been blended for a period of time of less than 20 minutes.

10 134. The method of claim 133 wherein the pre-blend has been blended for less than 15 minutes.

135. The method of claim 133 wherein the pre-blend has been blended for about 10 minutes or less.

15 136. A method of making a particulated chewing gum base comprising the steps of:

a) pre-blending a hard elastomer and an elastomer plasticizer together into an elastomer/elastomer plasticizer pre-blend;  
b) pulverizing the elastomer/elastomer plasticizer pre-blend;  
and

20 c) mixing the pulverized elastomer/elastomer plasticizer pre-blend with a particulated gum base softener; thereby forming a particulated blend of gum base ingredients.

25 137. The method of claim 136 wherein a soft elastomer is also pre-blended with the elastomer/elastomer plasticizer pre-blend before it is pulverized.

138. The method of claim 136 wherein each of the ingredients used to make the particulated gum base has a size of less than 6 millimeters.

139. The method of claim 136 wherein a powdered filler is also pre-blended with the elastomer/elastomer plasticizer pre-blend before it is pulverized.

5 140. The method of claim 136 wherein the elastomer/elastomer plasticizer pre-blend comprises between about 20% and about 80% hard elastomer and about 20% and about 80% elastomer plasticizer.

10 141. The method of claim 136 wherein the hard elastomer is selected from the group consisting of styrene-butadiene rubber, butyl rubber, polyisobutylene with an average GPC molecular weight greater than 75,000 and mixtures thereof.

142. The method of claim 136 wherein the elastomer plasticizer is selected from the group consisting of rosin ester, terpene resin and mixtures thereof.

15 143. The method of claim 137 wherein the soft elastomer comprises polyisobutylene with an average GPC molecular weight of less than 75,000.

144. The method of claim 136 wherein a powdered filler is also mixed with the blend of particulated gum base ingredients to make the particulated gum base.

20 145. The method of claim 136 wherein an additional elastomer plasticizer is also mixed with the blend of particulated gum base ingredients to make the particulated gum base.

146. The method of claim 136 wherein a particulated wax is also mixed with the blend of particulated gum base ingredients to make the particulated gum base.

25 147. The method of claim 136 wherein a particulated polyvinyl acetate is also mixed with the blend of particulated gum base ingredients to make the particulated gum base.

148. A particulated chewing gum base comprising:

- a) a hard elastomer pulverized to less than 0.6 millimeters in size;
- b) a filler of less than 20 microns in size; and
- c) a particulated elastomer plasticizer;
- d) the particulated gum base being a free-flowing mixture of gum base ingredients.

149. The particulated chewing gum base of claim 148 wherein the maximum particle size in the mixture is 6 millimeters.

150. The particulated chewing gum base of claim 148 wherein the elastomer plasticizer is pre-blended with the elastomer, and then the elastomer/elastomer plasticizer pre-blend is pulverized.

151. The particulated gum base of claim 150 wherein a soft elastomer is also pre-blended with the hard elastomer and elastomer plasticizer.

152. The particulated gum base of claim 148 further comprising an emulsifier.

153. The particulated chewing gum base of claim 148 packaged into a shipping container.

154. A method of making a chewing gum composition comprising the steps of:

- a) adding a premixed blend of solid, particulated gum base ingredients, including a hard elastomer, an elastomer plasticizer, a filler and a softener, to a gum mixer;
- b) adding a powdered bulking agent to the gum mixer;
- c) adding a flavor to the gum mixer; and



d) mixing the premixed blend of particulated gum base ingredients, powdered bulking agent and flavor to make the chewing gum composition.

5           155. The method of claim 154 wherein at the time the powdered bulking agent is starting to be mixed with the gum base ingredients, the gum base ingredients are still in the form of a premixed blend of solid, particulated ingredients.

          156. The method of claim 154 wherein the powdered bulking agent is blended with the gum base ingredients before being added to the mixer.

10           157. The method of claim 154 wherein the hard elastomer has a particle size of about 0.6 millimeters or less.

          158. The method of claim 154 wherein the hard elastomer and elastomer plasticizer are pre-blended together and pulverized before being made into the premixed blend of solid, particulated gum base ingredients.

15           159. A free-flowing particulated gum base comprising particulated gum base ingredients of a size less than or equal to about 6 millimeters, said gum base being free of liquid ingredients and comprising a pulverized hard elastomer of less than 0.6 millimeters, a pulverized elastomer plasticizer, and softeners having a congealing point greater than 50° C.

20           160. An intermediate ingredient for a particulated chewing gum base comprising:

- a) a hard elastomer and
- b) an elastomer plasticizer;
- c) the hard elastomer and elastomer plasticizer being pre-

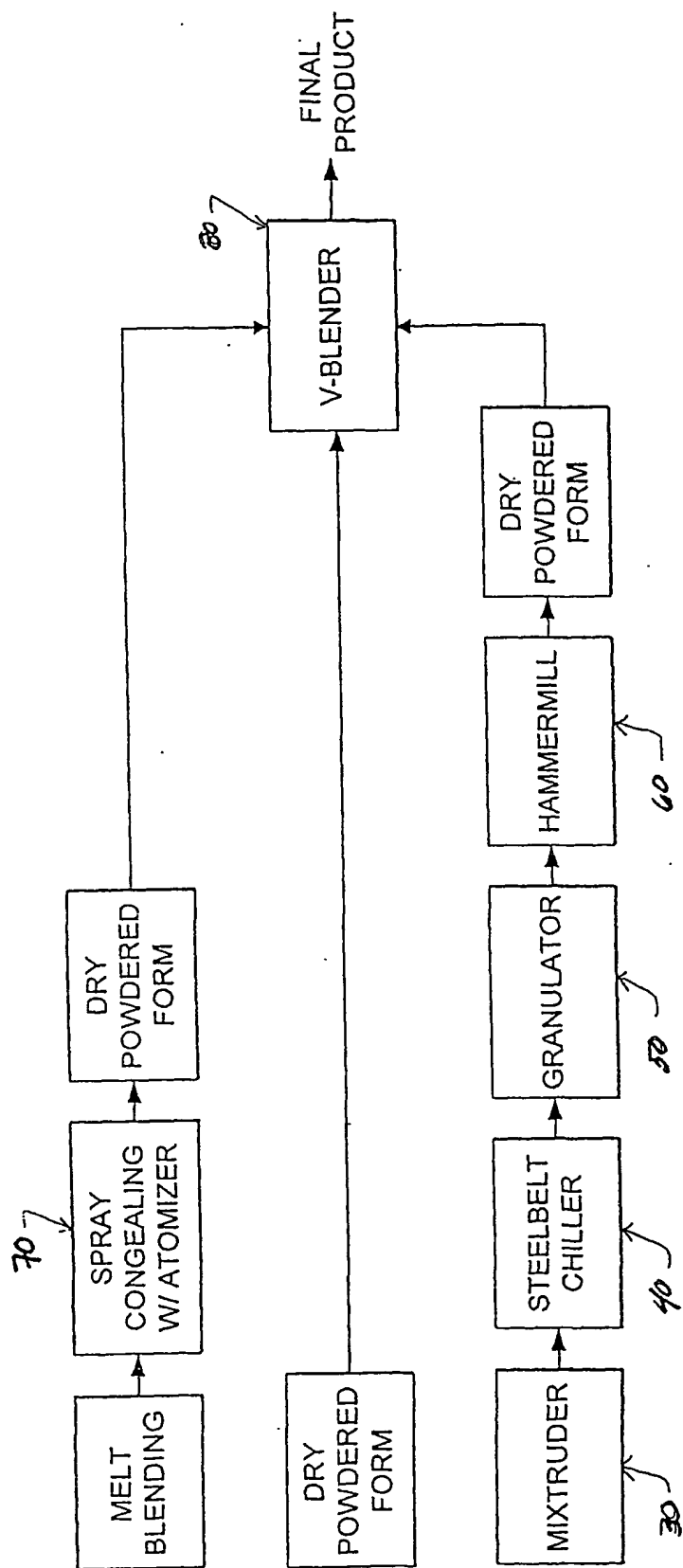
25           blended into a homogeneous composition and then pulverized to a free-flowing powder having a particle size of less than 6 millimeters.

          161. A method of making a particulated chewing gum comprising the steps of:

- a) pre-blending a hard elastomer and an elastomer plasticizer together into an elastomer/elastomer plasticizer pre-blend;
  - b) pulverizing the elastomer/elastomer plasticizer pre-blend; and
  - c) mixing the pulverized the elastomer/elastomer plasticizer
- 5 pre-blend with a particulated gum base softener and a powdered bulk sweetener, thereby forming a blend of particulated chewing gum ingredients.

FIG. 1

107



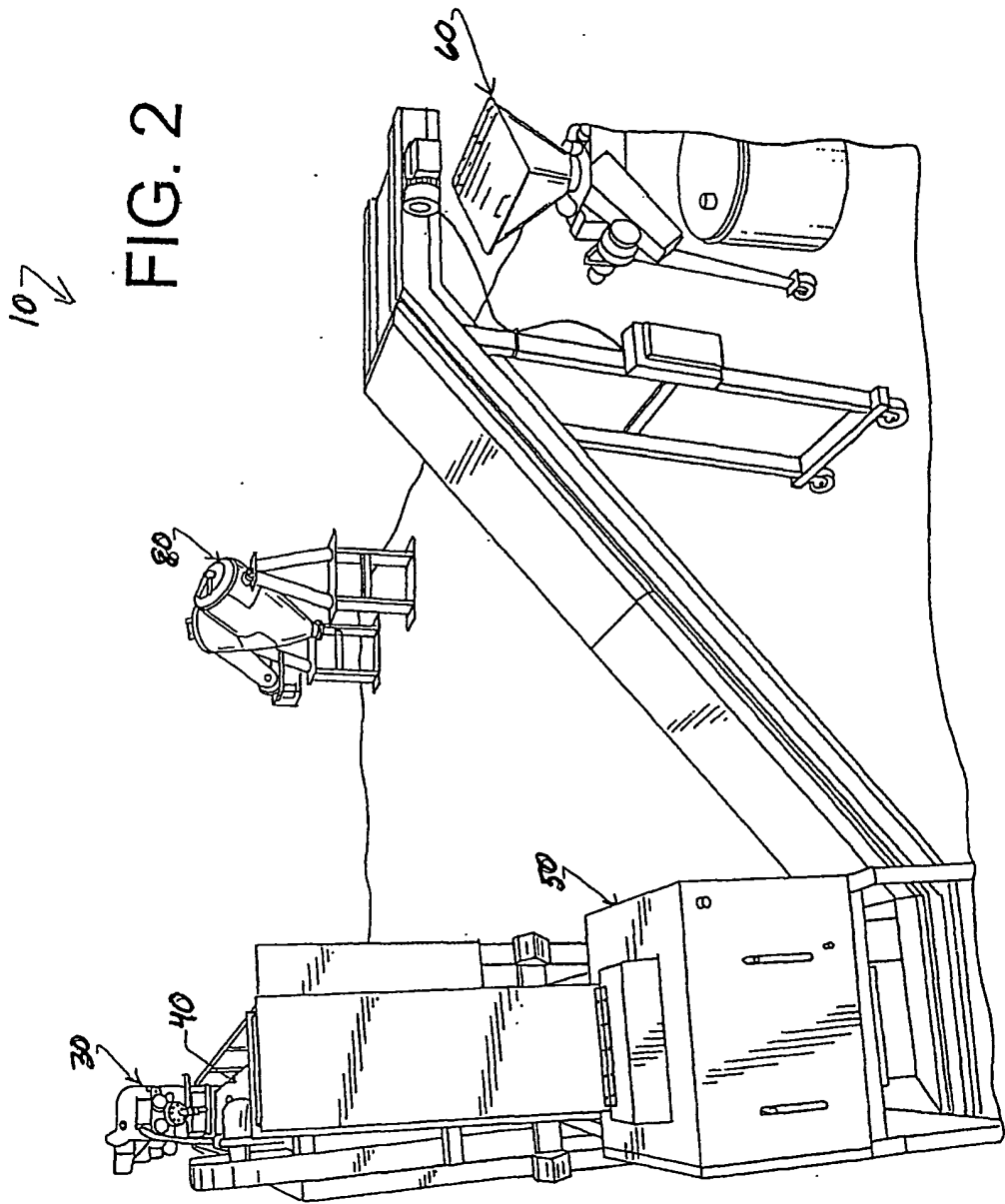


FIG. 3

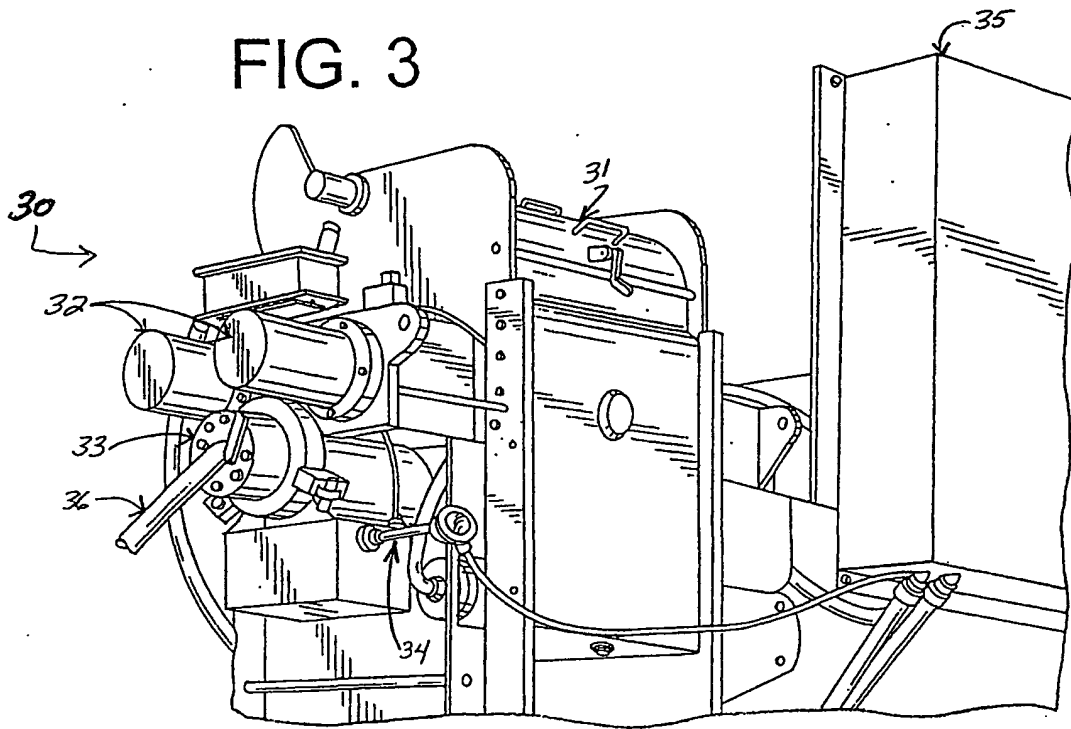
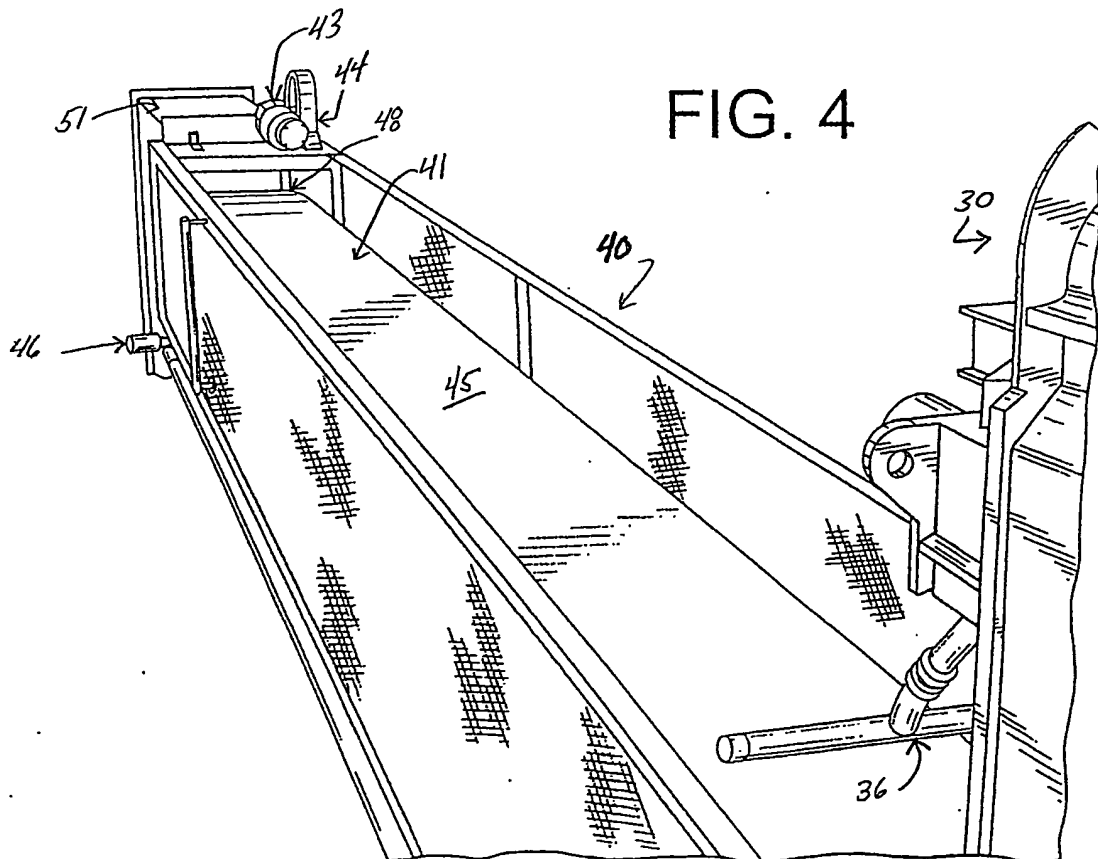
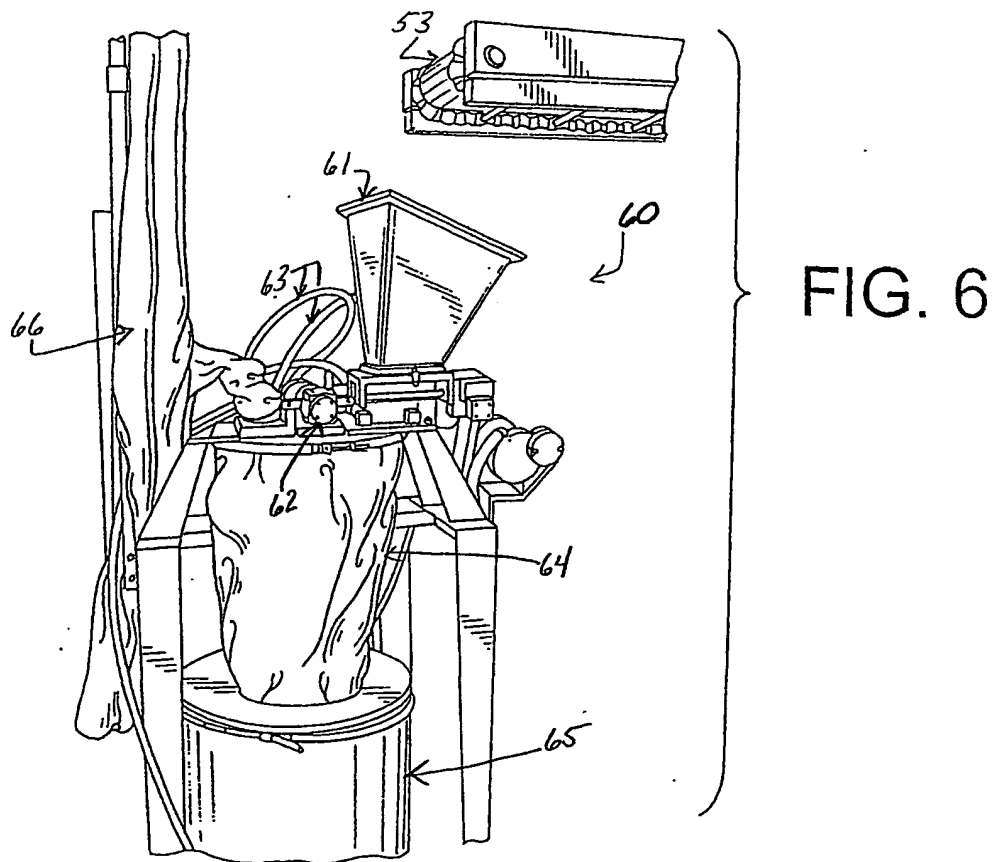
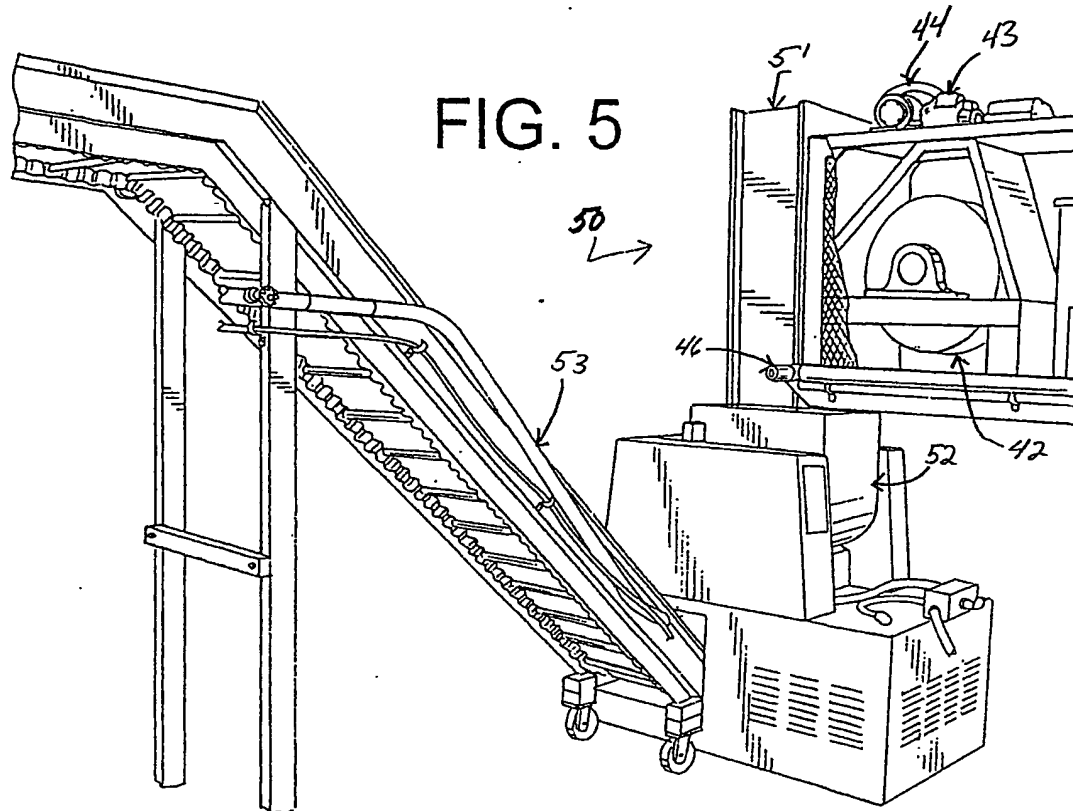
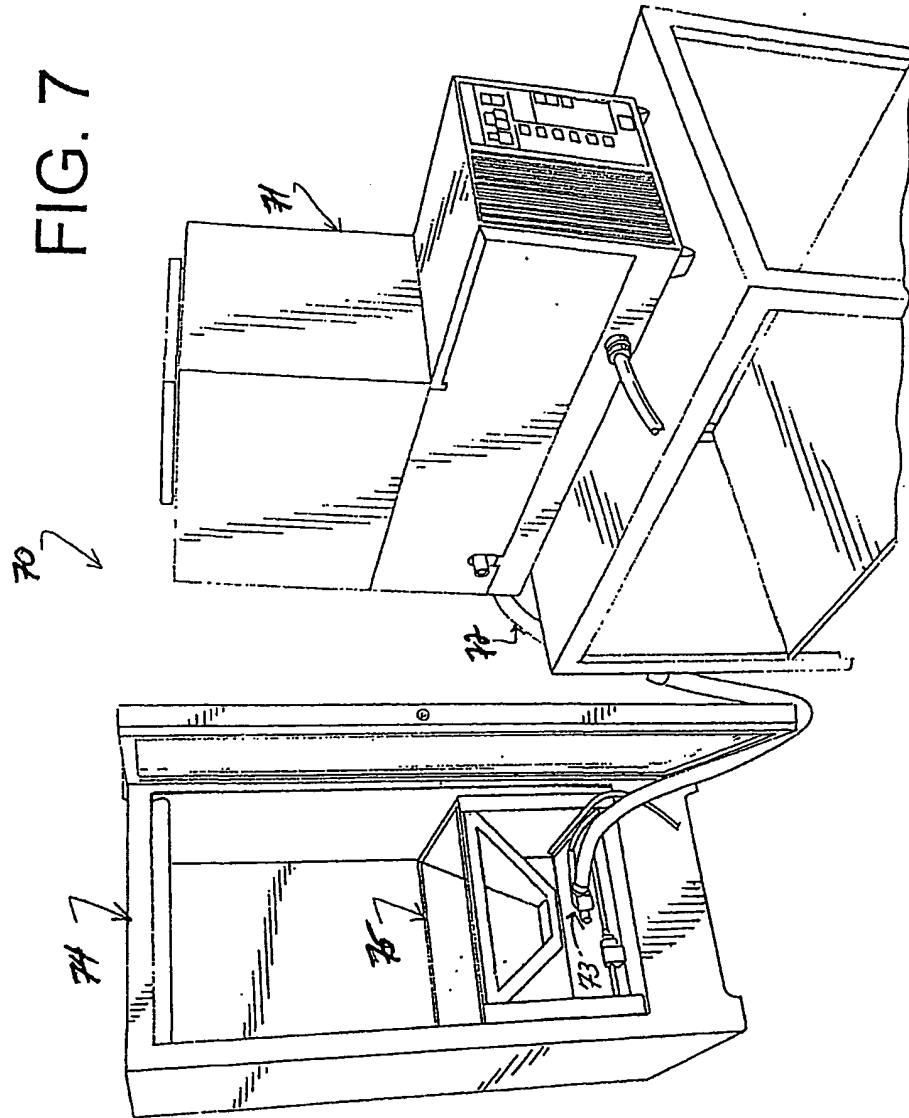
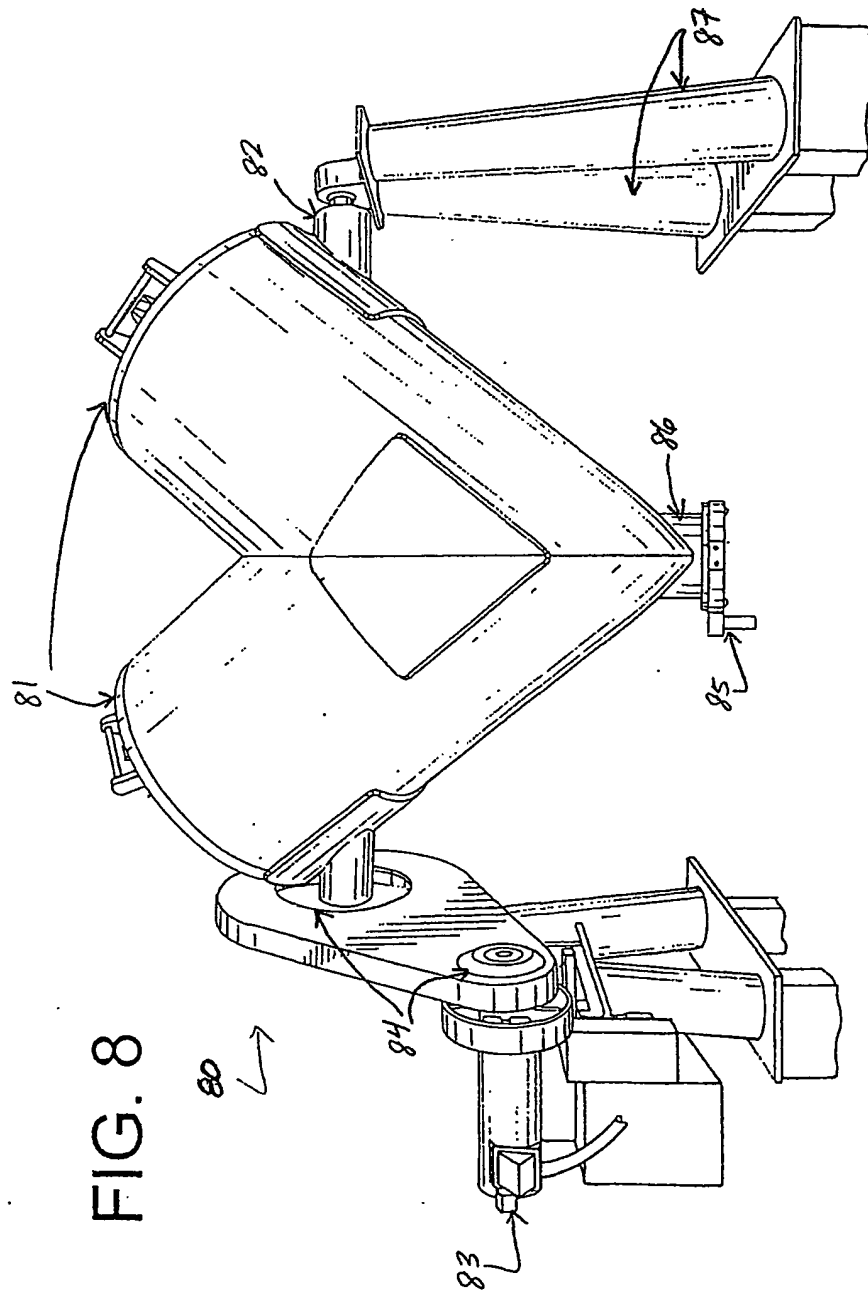


FIG. 4

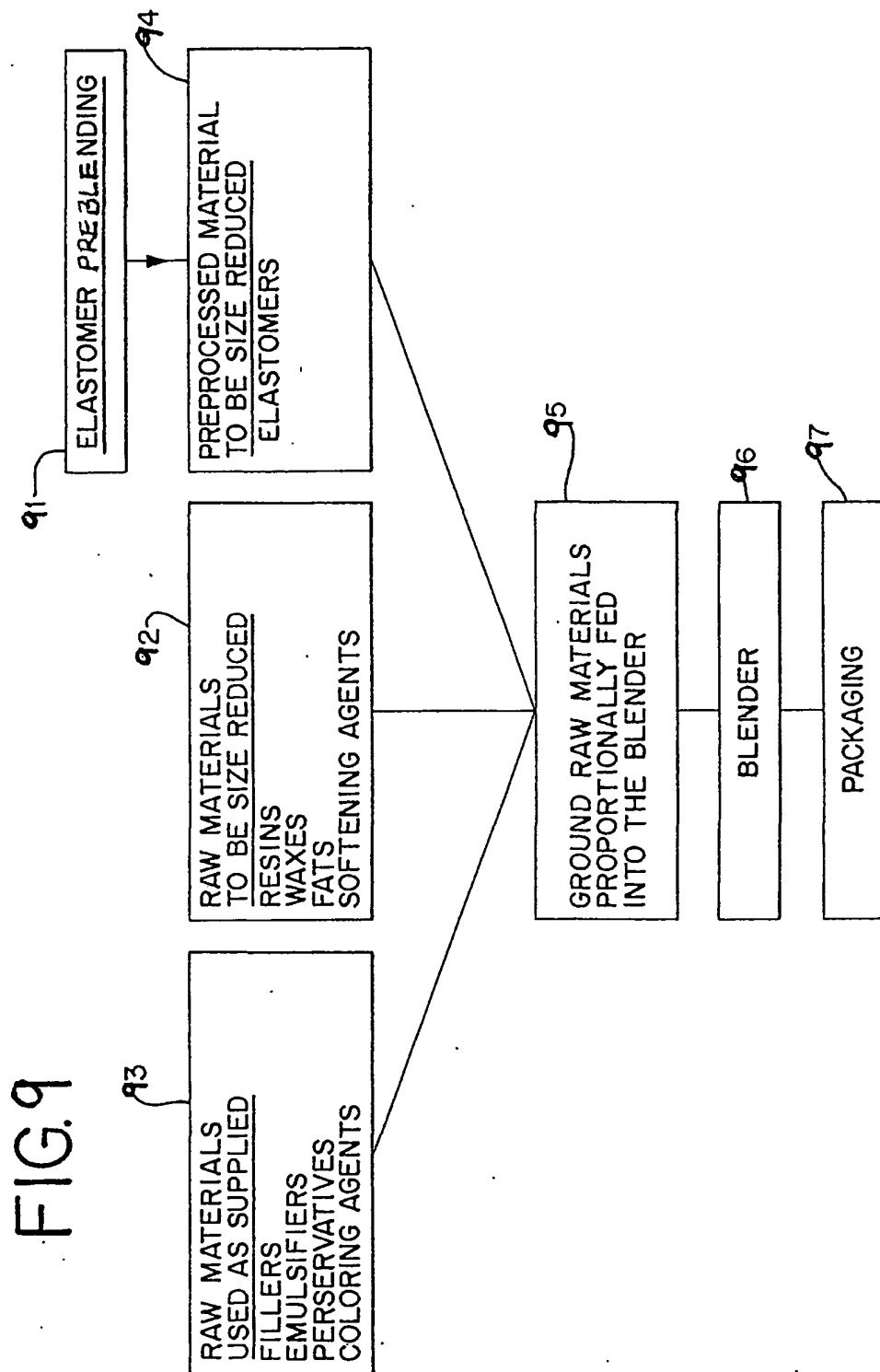












## INTERNATIONAL SEARCH REPORT

In ☐ national Application No  
PCT/US 01/08018

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 A23G3/30

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 A23G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 273 809 A (GEN FOODS FRANCE) 6 July 1988 (1988-07-06)  page 3, line 30 -page 4, line 8; claims 2-4; figure  ---	1,13, 117,118, 122-129
X	US 4 737 366 A (GERGELY GERHARD ET AL) 12 April 1988 (1988-04-12)  column 1, line 52 -column 2, line 9; claims 7-13; example 1 column 2, line 59 - line 68  ---  -/--	1,2,5,6, 8-10,57, 59,60, 62, 116-121

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the international filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*Z\* document member of the same patent family

Date of the actual completion of the international search

20 June 2002

Date of mailing of the international search report

04 07 2002

Name and mailing address of the ISA

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## INTERNATIONAL SEARCH REPORT

In ☐ International Application No  
PCT/US 01/08018

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"EXTRUSION: DOES CHEWING GUM PASS THE TASTE TEST?" FOOD MANUFACTURE, MORGAN-GRAMPIAN (PROCESS PRESS) LTD. LONDON, GB, vol. 62, no. 9, 1 September 1987 (1987-09-01), pages 47, 49-50, XP000564540 ISSN: 0015-6477 page 47; figure page 49 -page 50	122, 123, 125-129
A	WO 96 28044 A (WRIGLEY W M JUN CO) 19 September 1996 (1996-09-19)	1-6, 136-147, 161
X	example 1	117
X	US 5 582 852 A (AHN SUNG A ET AL) 10 December 1996 (1996-12-10)  column 1, line 54 -column 2, line 63; claims	1, 2, 11, 117-119, 121
X	US 4 597 970 A (SHARMA SHRI C ET AL) 1 July 1986 (1986-07-01)	32-37, 51, 57, 59, 60, 62-64
A	column 8, line 62 -column 9, line 24; example 1	1, 7, 8, 26-31
A	FR 2 635 441 A (GEN FOODS FRANCE) 23 February 1990 (1990-02-23)	136-147, 161
X	page 4, line 27 -page 5, line 16	117
X	US 2 290 120 A (THOMAS CHRISTOPHER F) 14 July 1942 (1942-07-14) page 2, line 34 - line 51	116
A	US 5 944 266 A (DEGADY MARC ET AL) 31 August 1999 (1999-08-31)	

# INTERNATIONAL SEARCH REPORT

ational application No.  
PCT/US 01/08018

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:  
1-14, 26-64, 116-129, 136-147, 161
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US 01 08018

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

### 1. Claims: 1-14, 117-121, 136-147, 161

A method of making a chewing gum and a chewing gum base comprising the steps of:

- providing at least one first gum base ingredient having a softening point of less than about 130 F
- providing a second chewing gum ingredient
- combining said first and second ingredient to obtain a blend in particulated form.
- blending the combined ingredients with at least a third gum ingredient

### 2. Claims: 15-25

Method of making a particulate blend gum base that uses soft elastomers

### 3. Claims: 26-41

Method of making a particulate gum base or gum base ingredient comprising the steps of melting together a fat and a wax and cooling the blend to form a particulate material, optionally blending said particulate material with other particulate gum base ingredients.

### 4. Claims: 42-48, 51-56

Method of making a particulate gum base comprising the steps of:

- melting a gum base ingredient
- spraying the melted gum base ingredient through a atomizing nozzle and cooling the ingredient
- blending with other gum base ingredients.

### 5. Claims: 49, 50, 57-64

Method of making a particulate gum base or gum base ingredient comprising the steps of:

- blending two or more gum base ingredients in a liquid form to form a combined ingredient having a viscosity of less than 80,000 centipoises at about 250 F.
- solidifying the blend in particulated form
- blending the particulated ingredient with at least one other gum base ingredient.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US 01 08018

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

6. Claims: 65-74

Method of preventing agglomeration of one or more particulate gum base ingredients through the use of an anti-caking agent.

7. Claim : 75

Method of preventing agglomeration of one or more particulate gum base ingredients through agitation of the blend of particulate gum base ingredients until just prior to the addition of the blend of particulate gum base ingredients to a gum mixer.

8. Claims: 76-78

Method of manufacturing gum base so as to have a high degree of consistency from one batch to the next.

9. Claims: 79,80

Method of manufacturing a first gum base having a first composition and subsequently manufacturing a second gum base having a second composition, using the same equipment and minimizing the amount of the first composition carried over in the second composition between the manufacture of the first gum base and the second gum base using a mixer retaining less than about 1% of the volume of the mixer.

10. Claims: 81-87

Method of making a particulate gum base from a plurality of gum base ingredients in a particulate form comprising the steps of:

- providing a plurality of storage compartments
- providing automated remote controls
- selecting a gum base to be made
- remotely acting said controls to dispense a desired amount of each gum base ingredients in particulate form from the storage compartments
- blending the desired amounts of the plurality of gum base ingredients to form a particulate blend gum base.

11. Claims: 88-97

Method of making a batch of gum comprising the steps of:

- providing one or more containers that contains a plurality of gum base ingredients in particulate form
- emptying the entire contents of said one or more containers into a gum mixer

## FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

- adding additional gum ingredients to the gum mixer
- mixing the gum base ingredients and additional gum ingredients to form a batch of gum.

## 12. Claims: 98-115,130

Method of manufacturing gum comprising the steps of:

- providing a plurality of particulated gum base ingredients
- providing additional gum base ingredients
- adding a combination of the particulated gum base ingredients to a gum mixer as a particulate blend; the gum mixer having an initial kettle temperature of 20 C to 40 C
- adding the additional gum ingredients to the mixer;
- mixing the combination of ingredients in the gum mixer to form a gum composition.

## 13. Claim : 116

Method of making a gum composition using reduced temperature comprising the steps of:

- providing a gum base ingredient in particulate form
- adding the particulate gum base ingredients to a gum mixer
- adding additional gum ingredients to the mixer and mixing all of the ingredients to form the gum composition, the content of the mixer not exceeding a temperature of 120 F throughout the mixing process.

## 14. Claims: 122-129

Method of making a chewing gum composition that contains a temperature sensitive ingredient comprising the steps of:

- providing a particulate blend gum base
- adding the particulate blend gum base to a gum mixer
- adding other gum ingredients including said temperature sensitive ingredient to the gum mixer and mixing the ingredients to form a chewing gum composition, the temperature sensitive ingredient being mixed into the other ingredients earlier in the mixing process than when the temperature sensitive ingredient is conventionally mixed into the chewing gum composition made using a melted gum base or mixing said temperature sensitive ingredient for a period of time shorter than the period of time required to mix a conventional gum composition using a melted gum base or mixing the temperature sensitive ingredient into the other ingredients with the initial addition of gum ingredients in the mixing process.

## 15. Claims: 131-135

Method of making a gum composition and wrapping gum products made therefrom without the need to condition the gum

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US 01 08018

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

composition prior to wrapping.

## 16. Claims: 148-153

Particulated chewing gum base comprising:

- a hard elastomer pulverized to less than 0.6 millimeters in size

- a filler of less than 20 microns in size

- a particulated elastomer

The particulated gum base being a free-flowing mixture of gum base ingredients.

## 17. Claims: 154-159

Method of making a chewing gum composition comprising the steps of:

- adding a premixed blend of solid, particulated gum base ingredients, including hard elastomer, an elastomer

- plasticizer, a filler and a softener to a gum mixer

- adding a powdered bulking agent to the gum mixer

- adding a flavor to the gum mixer

- mixing the premixed blend and other ingredients to make the chewing gum composition.

## 18. Claim : 160

Intermediate ingredient for a particulated chewing gum base comprising:

- a hard elastomer

- an elastomer plasticizer

- the hard elastomer and elastomer plasticizer being

- preblended into a homogeneous composition and then

- pulverized to a free flowing powder having a particle size of less than 6 millimeters.



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/08018

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